Prepared for:
510 North Peshtigo Court
Chicago, IL

Work Plan for Investigation and Removal of Radiologically-Contaminated Fill at 510 North Peshtigo Court

AECOM
December 2015
Project No.: 60442737

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December 18, 2015
Revised January 6, 2016

Ms. Verneta Simon
U. S. Environmental Protection Agency
Region 5
77 W. Jackson Blvd., SE-5J
Chicago, Illinois 60604

Re: Work Plan for Investigation and Removal of Radiologically-Contaminated Fill, 510 North Peshtigo Court, Chicago, Illinois – AECOM Project No. 60442737

Dear Ms. Simon:

Enclosed please find the Work Plan for the above-referenced site for your review and comment. This plan includes the revisions requested by the USEPA dated December 4 and 22, 2015 as well as those of January 6, 2016. Please note that this work plan is based on the original work plan previously approved for work on the former Kraft building site. We also will be providing two hard copies for your use and distribution.

Please contact us with any questions you have regarding this letter or the reported results.

Regards,

Andrew Kozak
Environmental Engineer

Steven C. Kornder, Ph.D.
Senior Project Geoscientist

cc: D. Biernacki, RMW Streeterville, LLC.
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WORK PLAN FOR INVESTIGATION AND REMOVAL OF RADIOLOGICALLY-CONTAMINATED SOIL AT 510 NORTH PESHTIGO COURT

1.0 INTRODUCTION

This Work Plan was developed for the investigation and removal of radiologically-contaminated fill at 510 North Peshtigo Court (Site) in Chicago, Illinois. The Site (included with the red outlined area on Figure 1) is bounded by East Illinois Street, East Grand Avenue, North Peshtigo Court, and an underground parking garage. The Site is currently referred to as "Part of Parcel 3 – Part of Lot 3" on Figure 1. The Site consists of a single irregularly shaped parcel on the easternmost side of the block covering approximately 0.5 acres. The parcel contains a 0.2 acre gravel lot used as a dog park as well as an unused dirt and grass area. The plat of survey for the block showing the Site, the existing park, and existing structures is included in Appendix A.

The block was previously covered by the former Kraft building and associated parking lots. A Work Plan for the entire block was approved by the United States Environmental Protection Agency (USEPA) on December 5, 2005. With the exception of the current Site area, the implementation of the former Work Plan resulted in the complete radiological surveying of the urban fill and remediation of the contaminated fill discovered during the investigation. The USEPA acknowledged the completion of these activities with the issuance of a Completion Letter on October 17, 2007 (refer to Appendix B).

With the approval of the USEPA, this Work Plan is an updated version of the original developed for the former Kraft building and parking lot area. As with the original Work Plan, a standalone Quality Assurance Project Plan (QAPP) is not being developed since this is a non-complex removal. Therefore, the standard operating procedures and plans typically found in the QAPP have been included with this Work Plan. The Site is being investigated as part of a proposed residential development. Current plans call for construction of a 68-story residential tower and upgrades to the existing 1.7 acre park. The Work Plan describes the:

- Procedures for managing the removal of radiologically-contaminated fill above the 7.1 picocuries per gram (pCi/g) removal action level.

- Survey methods proposed for identifying potentially radiologically-contaminated materials during the excavation and construction activities.

- Closure Report and Documentation of the work activities performed relating to the removal of radiologically-contaminated soil including health and safety procedures.

Following review and approval of this Work Plan by USEPA, activities will begin with one of two scenarios described herein. The first scenario consists of screening that will occur concurrently with excavation as necessary for the construction of the residential high-rise and connection to the adjacent parking garage. The second scenario consists of the anticipated screening of essentially 100% of the fill material within the Site down to native soil. To accomplish this screening, the second scenario will likely include removal of adjacent sidewalks to allow for a 1:1 slope into the Site. Ultimately, whether the second scenario is implemented depends on the negotiations with the USEPA for reimbursement of the significantly higher costs associated with the screening and expanded excavation necessary to completely screen the urban fill in 18-inch lifts down to native soil.

Screening activities will be directed toward the identification of radiological contamination within the urban fill. Radiologically-contaminated material that is excavated will be transported to a disposal facility licensed and approved to dispose of this material. After surveying activities and removal of contaminated material required by this Work Plan has been completed, a report will be prepared documenting the removal activities. The USEPA will be requested to prepare a “Certification of Completion Letter” acknowledging the completion of the investigation and removal of contaminated fill material. This “Certification of Completion Letter” is requested to acknowledge that conditions at the site are protective of human health and the environment and, if applicable, that no further remediation is necessary.

2.0 BACKGROUND

2.1 Site Location

The Site is located in an area of reclaimed land where fill material was placed along the Lake Michigan shoreline starting in the 1860's. This area of Chicago is commonly referred to as Streeterville. Recent developments in the Streeterville area of Chicago encountered radiologically-contaminated fill. These near surface fills are generally 8-12 feet thick and are primarily sandy urban fill that contains some soil along with bricks, mortar, broken concrete, wood and cinders.

The radiologically-contaminated materials were originally generated as waste by the former Lindsay Light thorium gas mantle production facilities which used and produced thorium nitrate in its manufacturing process. During construction and utility activities, thorium contaminated materials have been identified in fill materials throughout Streeterville. The Lindsay Light manufacturing operations were located at 22 West Hubbard Street, 161 East Grand Avenue, and 316 East Illinois Street in Chicago, Illinois. These manufacturing operations were conducted from the early 1900s through the early 1930s. The thorium contamination typically consists of elevated concentrations of thorium and associated decay products in the fill near the former Lindsay Light facilities. In addition, asbestos containing lantern mantle string ties have also been identified in fill materials. USEPA has directed the investigation and cleanup of radiologically-contaminated fill at a number of Streeterville properties. Due to the presence of thorium contamination at the parcels adjacent to and in the same block as the subject project and documented thorium cleanups at other properties in the Streeterville area, screening for thorium-contaminated fill is warranted where excavation work is planned. Furthermore, the USEPA, which has oversight authority for radiologically- contaminated CERCLA sites, requests that radiological surveys be completed prior to and during site development within the area designated and commonly referred to as the Streeterville Thorium Investigation Area.

Like most properties within the Streeterville Thorium Investigation Area, this Site has undergone more than one phase of redevelopment. Redevelop of the properties generally results in demolition debris and excavation spoil (mainly urban fill) that were reused as fill on-site or in the past at other locations. The construction of high-rise buildings built on deep caissons has also generated soil fill that was derived from the native sand and clay formations. As indicated previously, thorium contaminated wastes from the Lindsay Light operations were apparently used as fill on properties in Streeterville. As properties were redeveloped, the thorium contaminated fill materials were unknowingly mixed with other fill materials and reused on adjacent properties. Since the filling history of Streeterville properties is often complex and/or unknown, distinguishing between different fill materials and native soil during

these investigations is important to understanding the Site. As such, definitions for several terms used within the work plan are provided below.

Radiologically-contaminated Fill – material exhibiting thorium contamination exceeding the Lindsay Light Thorium Removal Action Level of 7.1 pCi/g for radium-228 plus radium-226.

Soil (earth) -sediments or other unconsolidated accumulations of solid particles produced by the physical and chemical disintegration of rocks, and which may or may not contain organic matter. (ASTM D653-14 Standard Terminology Relating to Soil, Rock, and Contained Fluids)

- Subsoil: 1) soil below a subgrade of fill; or 2) that part of a soil profile occurring below the "A" horizon. (ASTM D653-14 Standard Terminology Relating to Soil, Rock, and Contained Fluids)

- Topsoil: as used for landscaping purposes, usually the original surface layer of grassland or cultivated land. It does not generally include soil from peat lands or other special areas, such as land disturbed by industrial activity. Topsoil is usually a darker shade of brown, grey, or red than the subsoil that lies immediately beneath it, because it contains organic matter intimately mixed with the mineral matter. Topsoil tends to be more friable and pervious than inorganic soils. (ASTM Standard D5268-13 Standard Specification for Topsoil Used for Landscaping Purposes).

Demolition or General Construction Debris - non-hazardous, uncontaminated materials resulting from the construction, remodeling, repair, and demolition of utilities, structures, and roads, limited to the following: soil, wall coverings, reclaimed asphalt pavement, rock, plaster, glass, non-hazardous painted wood, drywall, plastics, non-hazardous treated wood, plumbing fixtures, electrical wiring, non-hazardous coated wood, non-asbestos insulation, bricks, wood products, roofing shingles, concrete, and general roof coverings. (Source: http://www.epa.illinois.gov/topics/waste-management/waste-disposal/household-hazardous-waste/disposal/index)

Native Materials - soil, sand, or rock that was present prior to the application of fill. This refers to in-situ (undisturbed) native materials. In Streeterville, screening for thorium contamination is not required for in-situ native materials. However, screening for thorium may be required for native materials that were derived from other properties (or dredged from the river or lake) unless the origin of the material is known.

Fill - man-made deposits of natural soils or rock products and waste materials (ASTM D653-14 Standard Terminology Relating to Soil, Rock, and Contained Fluids). Fill components may include a variety of identifiable materials including brick, cement, wood, wood ash, coal, coal ash, boiler ash, clunkers, other ash, asphalt, glass, plastic, metal, inert, demolition debris, and roadside ditch materials.

- Urban Fill – In this document urban fill is used to describe a subset of fill that contains both natural (soil, sand and stone) and man-made (brick, cement, wood, wood ash, coal, coal ash,

boiler ash, asphalt, glass, etc.) materials. Thorium contamination is usually found in urban fill material. The urban fill term is used to differentiate this material from fill composed natural materials like soil, sand and rock. Fill composed predominantly of soil will be call "soil fill".

- Clean Fill - clean construction or clean demolition debris is defined as uncontaminated broken concrete without protruding metal bars, bricks, rock, stone, reclaimed asphalt pavement, or soil ~~dirt~~ or sand generated from construction or demolition activities. (Source: http://www.epa.illinois.gov/topics/waste-management/waste- disposal/household-hazardous-waste/disposal/index).

2.2 Site History

The City block formerly consisted of two parcels. Parcel 21 occupied the western portion of the block while Parcel K occupied the balance of the block to the east (refer to Figure 2). The Site is located on former Parcel K. STS (now part of AECOM) conducted Phase I Environmental Site Assessments (Phase I ESAs) at Parcels 21 and K, which are summarized in STS's reports dated April 4 and April, 12, 2002, respectively. The Phase I ESAs included review of Sanborn Fire Insurance Maps dating from 1891, 1903, 1906, 1927, 1950, 1975 and 1988. Historic site use observed in the Sanborn maps is summarized below.

The Site was used as an open lumber yard and mill works facility between 1891 and 1906; as vacant land with a railroad track (spur) crossing the central portion of the Site in 1927. Parcel K was developed in 1937 with a 9-story masonry building (with a one-level basement) by Kraft Cheese Company for use as a cheese and salad dressing factory and cold storage warehouse. The building was used as office space by the City of Chicago from 1978 through 2000 and was then demolished in 2003. From 2003 to 2006, Parcel K has been predominantly utilized as a parking lot with a landscaped area at the eastern boundary. In 2007, the existing building structures were built on former Parcel 21 and the 4-level underground parking garage was constructed on the majority of parcel K. The property boundaries were also redrawn with the building structures and parking garage becoming Parcel 1 and undeveloped approximately 0.5 acre portion becoming Parcel 2. Major portions of Parcel 2 lie within the boundaries of the former Kraft building's foundation walls. For the upcoming Site development, Parcel 2 was renamed as "Part of Parcel 3 – Part of Lot 3" as shown on Figure 1.

2.3 Site Lithology and Groundwater Conditions

Borings installed in May of 2005 for the down-hole survey (refer to Section 2.6) outside of former building foundation on Parcel K are consistent with the earlier site information. The 2005 borings indicate about 6-inches of asphalt and gravel base course underlain by 8.5 to 14 feet of urban fill (an average urban fill thickness is about 10 feet). Borings installed in 2005 within the former foundation indicated 10 to 15 feet

of debris, which was composed of crushed brick and concrete characteristic of demolition debris from the former Kraft building. Groundwater was encountered at a depth of 10 feet bgs in both the 1992 and 2005 studies.

2.4 Radiological Walk-Over Surveys

The surface of the former parking lots in Parcels 21 and K were surveyed over a three-day period in September 2000 by STS. Representatives from the USEPA were present during the majority of the survey field time and conducted their own walkover survey. The STS walkover survey consisted of two components, a gamma measurement on a 5-meter grid and a gamma scan for elevated readings within each 5-meter grid cell (STS, November 2000). Elevated gamma readings were defined as readings that exceeded the general background values by a factor of two or more. Background values for the site using a Ludlum 2221 meter with a Ludlum 44-10 2 x 2-inch NaI probe ranged from 4,650 to 6,800 counts per minute (cpm). The North Lot, located in Parcel K did not exhibit an area with distinct indications of radiological contamination.

In June of 2003 URS Corporation (URS, now part of AECOM) conducted gamma radiation surveys and radiological fill sampling at the Site for the presence of elevated levels of radioactive materials (URS, July 2003). The area included the former exterior North Lot (Parcel K) adjacent to the Kraft Building where the dog park is currently located and the basement floor within the building. Surveys were performed using a Ludlum Model 2221 with either a 3 x 3-inch NaI probe or a Ludlum Model 2350-1 data logger coupled with a Ludlum Model 44-10 2 x 2-inch NaI detector. The parking lot survey utilized a 10-meter grid with readings taken within 1-meter sub-grids (100 readings per 10-meter grid). Results of the survey indicated that measurements from the North Parking Lot in Parcel K were all less than 2-times the background level criterion.

URS also used a direct-push hydraulic rig (Geoprobe™) to collect fill or soil samples within 4-feet of ground surface for total radium analysis. Ten samples were obtained from the parking lot during the June 2003 URS survey. Five of the samples were obtained from the fill pile adjacent to the former Kraft building, while the remaining five samples were spaced evenly across the North Lot since the surface survey did not identify elevated gamma readings.

The URS fill analysis did not detect total radium at levels in excess of the USEPA removal action level of 7.1 pCi/g total radium. In fact, except for URS sample B1, the fill sample results were less than the USEPA background for total radium (USEPA has established background equal to 2.1 pCi/g total radium for Chicago). The result for sample B1 (2.7 pCi/g total radium) was only slightly above the background level. Thus, the surface survey and fill sampling conducted by URS in the North Lot did not observe

readings that would be characteristic of radiological contamination. However, in correspondence dated August 22, 2003, the USEPA indicated that the results of the surface gamma survey and the fill analysis did not conclusively rule out the presence of radiologically-contaminated material since surface obstruction (asphalt pavement) limited the extent of the surface survey and fill samples were not collected from the full depth of the underlying fill material.

2.4.1 Former Kraft Building Basement Survey

As mentioned above, in June 2003 URS (URS, July 2003) conducted a survey of the basement floor within the former Kraft building prior to demolition. The grid spacing within the basement utilized the existing support columns that were spaced at approximately a 6-meter interval. The 6-meter grid was further subdivided into 2 X 2 meter sub-grids with the gamma measurements recorded at the center of each grid. The majority of the basement floor survey readings were reported to be less than 2-times background. The areas with survey readings greater than 2-times background were either ceramic tiled or in the vicinity of stored ceramic tiles. According to the report, tiles similar to those found in the building have generally been found to contain levels of natural radioactivity consistent with the elevated readings found in the basement. Thus, no indications of radiologically-contaminated material beneath the basement floor were detected by the URS survey, although the basement floor potentially could inhibit (shield) low-level radiologically-contaminated material from being detected.

2.5 Building Demolition

In late 2003, a former owner and developer of the property demolished the aboveground portions of the former Kraft building. The subsurface portions of the basement (i.e., walls and floor) were left in- place. The basement floor slab was broken up, but left in-place, to prevent water from being retained within the former foundation. The inorganic demolition debris (i.e., concrete, brick, etc.) from the building was used to fill the basement foundation. The demolition debris was covered with a gravel base course, graded and surfaced with asphalt to allow utilization of the area as a parking lot.

The demolition debris utilized for fill within the former foundation did not contain fill material derived from other portions of the property or adjacent sites that could potentially contain radiologically-contaminated material. Thus, it is not necessary to conduct radiological screening of the debris within the former foundation during excavation activities. However, since the former Kraft building was built in 1937, it has not been confirmed conclusively whether fill, which may be radiologically-contaminated, is present beneath the basement floor. Although, the basement floor survey (URS, July 2003) indicated no evidence of radiological-contamination, the basement floor could have shielded gamma emissions. Therefore, it is anticipated that visual verification of the absence of urban fill material (and radiological surveying if urban

fill material is present) beneath the basement foundation will be necessary if removal of the former basement slab/foundation is required. When AECOM pursues visual verification then AECOM shall immediately contact USEPA so USEPA can also conduct visual verification.

2.6 2005 Down-hole Project Scope

Results of the previous surface gamma surveys of Parcels K and 21 were used to develop an approach for a down-hole radiation survey. A copy of the screening work plan (STS, May 2005) was submitted to the USEPA for review prior the initiation of the field activities. The screening plan proposed to evaluate the potential presence of radiological contamination at eighteen (18) boring locations, five (5) of which were at locations within the current Site. Three (3) of the borings (B-16, B-18 and B-20) were completed within the footprint of the former Kraft building, while two (2) were located (B-13 and DH-4) just west of the former building foundation (refer to Figure 2 in Appendix C). A copy of the down-hole screening results and approximate boring locations is provided in Table 1 in Appendix C.

The down-hole radiation surveys for the soil borings were conducted between May 18 and June 10, 2005. The USEPA was present and observed the installation of the boreholes and down-hole gamma surveying. All borings were drilled with a nominal 4.25-inch diameter hollow stem auger. A 3-inch diameter Schedule 40 PVC casing was installed in each hole, and gamma readings were taken in 6-inch increments extending into the native soil. The gamma logging was conducted with a Ludlum 2221 and a 2 x 2 inch NaI probe. The probe was equipped with a 1-inch thick lead end cap and a ¼-inch lead ring at the lower end of the probe to minimize the influence of adjacent and deeper radioactive materials on the gamma readings (i.e., maximum lateral sensitivity in the survey).

In general, the 2005 borings installed outside of former building foundation indicated that the site consisted of about 6” of asphalt and gravel base course followed by between 8.5 to 14 feet of urban fill (average of about 10 feet of urban fill material), while borings within the former foundation indicated 10 to 15 feet of fill dominated by crushed brick and concrete characteristic of demolition debris from the former Kraft building. Table 1 in Appendix C presents a summary of the maximum gamma reading observed for each boring along with the corresponding depth at which the maximum value was recorded. The borings all indicated gamma readings below 7,633 counts per 30-seconds (instrument value equivalent to the USEPA limit of 7.1 pCi/g). Thus, there were no indications of contaminated fill. The complete list of the down-hole gamma surveys readings for each boring are presented in section D-1 of the original 2005 Work Plan.

2.7 2015 Environmental Survey

Radiation surveying was provided by AECOM on July 1 and 2, 2015 for 10 environmental borings performed by Pioneer Environmental Services, LLC. Surveying was performed on spoil from 9 environmental borings and the drilling spoil from one monitoring well installed at location B-8. The complete list of the gamma surveys readings for each boring are presented in Appendix D. Based on the gamma readings, there was no indication of the potential presence of contaminated fill.

Spoil and samples from each of the 2015 borings were surveyed for radiological contaminants. Based on historical drawings for the building footprint, the majority of the borings were located within the former Kraft building. Information for the demolition also indicated that the former basement slab was left in place and backfilled with demolition debris from the building, which the USEPA has agreed does not require radiological screening. Based on outline of the former building from drawings and the refusal encountered at a majority of the borings (i.e., the borings did not penetrate the former basement slab), only borings B-1 and B-6 appeared to be located outside of the former building foundation. The depth of urban fill at borings B-1 and B-6 was 15 and 10 feet, respectively. Boring B-1 is located within an area previously gamma screened during the original 2006 project. Boring B-1 is also located in close proximity to the garage wall. Thus, the deeper depth of fill at B-1 is attributed to excavation and backfilling of previously surveyed fill associated with the garage wall construction.

3.0 PROPOSED WORK ACTIVITIES

3.1 Scenario 1 - Construction Excavation Screening Only

Scenario 1 includes gamma screening during construction excavation activities that require the removal or excavation of fill that was not previously screened. Screening of demolition debris contained within the foundation of the former Kraft facility, however, is not required as described in Section 3.3.5 below. The activities will include probing for caissons, the mass excavation of fill necessary for construction of the foundations and elevator pits, as well as the installation of utilities. Under Scenario 1, it is anticipated that some urban fill material at the Site will not be excavated, and therefore will not be screened for the potential presence of radiological materials. Figure 3 is a draft drawing of the expected excavation depths for Site construction. It is anticipated that a majority of the fill that will not be screened will be in the northwest corner of the Site. It is not possible to accurately indicate the location of this material at this time because the depth of fill is not accurately known and the final construction depths may change. As such, the documentation produced during this phase will also include a drawing(s) indicating the areas of the unscreened urban fill that is intended to remain onsite. If radiologically-contaminated fill is discovered during screening, it will be remediated as described in the Methods Section 4.0 below.

3.2 Scenario 2 - 100% Excavation and Screening of Site

Scenario 2 will include excavation and the anticipated screening of 100% of the Site fill material down to the depth of native soils. Screening of demolition debris contained within the foundation of the former Kraft facility, however, it is not required as described in Section 3.3.5 below. Based on previous drilling investigations, native soils are encountered between 10 and 15 feet bgs. To perform this work safely and without the use of sheeting, portions of the sidewalks on the north and east edges of the site (approximately 12 foot wide) will be removed to allow for the walls of the site excavation to be sloped at approximately 1:1 ratio until native soils are encountered. All fill removed from underneath the sidewalks will be included in the radiation screening. If radiologically-contaminated fill is discovered during screening, it will be remediated as described in the Methods Section 4.0 below.

3.3 Activities to be performed under Either Scenario 1 or 2

The following general activities will be performed under either scenario.

3.3.1 Site Excavation and/or Grading

Portions of the Site will be excavated and/or graded periodically during the construction activities. It is important to note that gamma screening applies to fill and that screening of native soils will not be performed. Fill materials and/or soil that were brought to the Site to construct the park after the remediation efforts were completed are also excluded from further screening. Additionally, once a walk-over gamma survey is performed of a specific area, that area will not be surveyed again until an additional depth of 18-inches is excavated. Gamma walk-over surveying should be performed until native materials are encountered and, assumptions as to the depth to native materials should not be made.

Site excavation or grading screening will involve the surveying for radiologically-contaminated fill that, because of fill thickness, may have shielded the presence of a radiologically-contaminated soil during previous walk-over surveys. Walk-over surveys will be performed as excavation proceeds in the areas where the fill is in excess of 18-inches thick in accordance with Section 5.7 of SOP-210 (Appendix E), and until native materials are encountered. If identified, contaminated fill will be removed to levels below the removal action level. Grading/excavation will be limited to 18-inches or less between surveys.

Former building foundations or buildings with basements within the fill may require gamma screening. If discovered during the grading/excavation process, the potential presence of radiologically-contaminated fill materials below the floor slab or basement floor and fill material within the basement will be investigated (this is not meant to include the demolition debris within the former Kraft building foundation since it was derived from demolition of the Kraft building in 2003). Excluding the former Kraft building foundation, fill material within the basement structures will be surveyed using methods similar to those used for the excavation process (i.e., investigation in maximum 18-inch lifts through the full thickness of the basement fill).

Basement floor slabs, including the former Kraft building, will be investigated via potholing to determine if fill is present below the floor slab. If these potholing activities do not indicate the presence of fill beneath the slab and removal of the slab is not required for construction, then USEPA will be consulted to confirm that it is not necessary to completely remove these slabs for fill monitoring purposes. For Scenario 2, if fill is documented below the floor slabs, the method of investigation will consist of the removal of the floor, AECOM will then conduct a walk-over survey. The discovery and subsequent investigation of such structures will be included within the closure report for the Site.

3.3.2 Utilities and Grade Beams

The installation of utilities and grade beams will involve the installation of trench like excavations (less extensive than those of Section 3.3.1). These installations or excavations will likely occur prior to the excavation/grading and subsequent construction phases. Utility and grade beam excavations will be screened for the presence of radiologically-contaminated material when these activities are proposed for areas containing fill material which has not been previously surveyed. These surveys will be conducted in 18-inch lifts until the final depth of excavation is reached.

The ground surface will be surveyed for elevated gamma radiation prior to beginning excavation. Surveys will use a Ludlum 2221 and 2 x 2 inch NaI probe. The background gamma count will be recorded. Screening of the utility trenches and test pits may include one or more of the following survey efforts: survey of the excavation walls and floor, survey of the excavation spoil pile, or survey of the excavated fill while still in the excavator bucket.

Excavation will proceed in lifts not to exceed 18-inches per lift. The excavation walls and floor will be surveyed at each 18-inch lift, if the excavation can be entered safely or the probe can be suspended into the excavation via a longer cable. In the event the excavation is of such a dimension so as to preclude safe access to survey the walls and floor, surveys will be done of material in the excavator bucket and/or spoil pile to characterize the in-place material. If elevated gamma radiation measurements are noted, equal to or exceeding twice the background gamma count, the excavation will proceed in thinner lifts, 6 to 12 inches. The excavated fill will be surveyed in the excavator bucket before being added to the spoil pile.

If radiologically-contaminated materials are identified, contaminated fill within the Site property boundaries will be removed to levels below the removal action level. Areas containing contaminated fill above the 7.1 pCi/g removal action level will be remediated until they are below the 7.1 pCi/g action level, and remain designated as Exclusion Zones until the area is verified by USEPA. Work within a utility installation area designated as an Exclusion Zone will require appropriate personal protective equipment (PPE) and personal air monitoring as described in Section 5.4. Personnel entering Exclusion Zones must be 40-hour health and safety trained. All equipment and personnel that enter an Exclusion Zone will be frisked clean upon leaving the area.

3.3.3 Caissons

Installation areas for drilled foundation will generally be pre-screened (probed) in advance of the actual installation utilizing an excavator and the procedure outlined for utilities (Section 3.3.2). However, drilled foundations may be installed in or through the urban fill material without pre-screening. Spoil from drilled foundations will be screened for the presence of radiological contamination when the drilling activity is proposed for an area containing unscreened urban fill material. Radiological surveying will be limited to the fill materials. Native soil excavation and the associated spoil will not be surveyed for radioactivity. Urban fill spoil material exhibiting a radiological contamination above the 7.1 pCi/g removal action level will be managed for disposal according to Section 4.3. The excavation of radiologically-contaminated material to levels below the removal action level will not occur during the drilling phase, but during subsequent mass excavation activities.

3.3.4 Foundations

Foundation excavations will be screened for the presence of radiologically-contaminated material if the excavation activities are proposed for areas containing fill materials. These surveys will be conducted following the methodology for excavation of apparently clean fill (i.e., below the removal action level) in Sections 3.3.2. Excavations will be limited to not more than 18-inches between surveys. (Note that the 18-inch limit will not apply to caissons and/or drilled foundation elements due to the construction methods for such features. Similarly, spoil will be surveyed at the surface for excavations that, due to the nature of the construction, are unsafe to enter.)

If radiologically-contaminated materials are identified, contaminated fill within the Site property boundaries will be removed to clean limits. Areas containing contaminated fill above the 7.1 pCi/g removal action level will be remediated until they are below the 7.1 pCi/g removal action level, and remain designated as Exclusion Zones until the area is verified by USEPA. Work within a utility installation area designated as an Exclusion Zone will require appropriate personal protective equipment (PPE) and personal air monitoring as described in Section 5.4. Personnel entering Exclusion Zones must be 40-hour health and safety trained. All equipment and personnel that enter an Exclusion Zone will be frisked clean upon leaving the area.

3.3.5 Former Kraft Basement Foundation

As described in Section 2.5, in late 2003, the above ground portions of the former Kraft building were demolished. The subsurface portions of the basement (i.e., walls and floor) were left in-place, but the

floor slab broken up to prevent water from being retained within the former foundation. The demolition debris (brick and concrete) from the Kraft building was utilized as fill within the former foundation. As such, this debris does not contain urban fill material derived from other portions of the property or adjacent sites that could potentially contain radiologically-contaminated material. Thus, radiological screening is not proposed for the asphalt paving, sub-grade or demolition debris within the former foundation during the excavation of this material.

The basement floor survey (URS, July 2003) completed indicated no evidence of radiological contamination. However, the basement floor could have shielded gamma emissions. AECOM proposes that visual verification of the absence of fill material (and radiological surveying if urban fill material is present) beneath the basement foundation be conducted if removal of the former basement slab/foundation is necessary.

For fill below the floor, the method of investigation will consist of removal of the floor to gain access and subsequent performance of the walk-over survey if visual evidence of urban fill is present and the excavation can be entered safely. If the excavation cannot be entered safely, the spoil from the excavation will be screened as it is excavated and/or stockpiled adjacent to the excavation area. The results of this investigation will be included within the closure report for the Site. In addition, if AECOM pursues visual verification then AECOM shall immediately contact USEPA so USEPA can also conduct visual verification.

4.0 METHODS

4.1 Removal Action Level

The USEPA has set the removal action level as 5 pCi/g total radium (Ra-226 and Ra-228) above the background. A level of 2.1 pCi/g total radium is currently considered background for the area by the USEPA. Thus, radiologically-contaminated material is defined by the USEPA for the Streeterville area as exceeding a removal action level of 7.1 (pCi/g) total radium.

Field measurements will be taken of gamma radiation levels using a Ludlum 2221 and a 2 x 2 inch NaI detector. The equipment will be calibrated to determine the gamma count in counts per minute (cpm) that is equivalent to 7.1 pCi/g. Equipment calibration will be performed using the thorium calibration blocks at the former Tronox/Kerr-McGee West Chicago Rare Earth Facility or other USEPA-approved source.

Field measurements of gamma counts will include the following:

- Surveys of excavations as overburden below the removal action level is removed;
- Surveys of excavations as radiologically-contaminated fill is removed;
- Surveys of excavations to document all contaminated fill has been removed;
- Surveys of utility or foundation excavations; and
- Surveys of deep foundation excavations or drilling spoil.

4.2 Asbestos

In April 2014, at another Streeterville site, a sample was collected from a radiologically-contaminated area that visibly contained numerous 3-5 inch strings. Lab results of the polarized light microscopy (PLM) indicated the strings were approximately 20-25% chrysotile, a common form of asbestos. The asbestos containing strings appear directly related to the mantles and were likely used to tie the mantles to a ceramic fitting that attached to the gas lamps. Based on the comments from the USEPA regarding analyses conducted, AECOM understands that the mantle strings themselves were apparently dipped/coated with thorium. Therefore, the use of field instrumentation to remove the thorium contaminated fill is expected to effectively remove the mantle related asbestos string ties. These asbestos strings have not been documented previously at the Site. However, if observed the string ties will require a slight modification to the plans and procedures historically utilized for thorium contaminated fill. The USEPA will be notified should screening activities reveal the presence of string ties.

The overburden that is not radiologically-contaminated will be removed in lifts of 18-inches or less. Procedures for the handling and the management of the asbestos containing fill will be implemented prior to the excavation of the radiologically-contaminated fill since the asbestos appears to be related to the asbestos containing string ties that are visible within the thorium contaminated fill. If asbestos appears to be involved the air monitoring will be upgraded and asbestos related air monitoring and PAM analysis will be conducted. Asbestos related work will be conducted by a licensed asbestos abatement contractor, if necessary. During the excavation and handling of radiologically-contaminated materials, the procedures to be followed to control dust will include traffic speed control and potentially the use of water to keep the fill and/or soil moist. Radiologically-contaminated fill above the Project Action Level will be loaded directly into the Super Sack® type bulk storage bags as the material is excavated. Radiologically-contaminated material stored on-site will be stored in bulk storage bags that will be labeled and stored according to the applicable asbestos regulations.

In summary, based on conversations with the USEPA, the asbestos containing string ties are directly related to the mantles and gamma spectroscopy has confirmed that they have elevated radium activities. As such, the mantle ties will be detectable via gamma surveying. Therefore, removal of the thorium contaminated fill is expected to effectively remove the mantle related asbestos.

4.3 Surficial Walk-over Surveys

Surficial survey methods will be used in this project to initially identify the potential presence of radiologically-contaminated materials. The same general techniques will be used for site-wide grading and/or excavation screening to survey for the presence of contamination. Additionally, those areas currently covered by pavement and/or buildings that precluded the survey of exposed fill, will be subject to walk-over surveys. If necessary, paving stones, asphalt, concrete and the associated gravel base course will be removed prior to conducting the walk-over survey. A grid with a 20-foot spacing will be marked by stakes and flagging at the edges of the project area or by paint on the ground surface on the interior of the site. The areas between the grid points will be scanned to cover 100 percent of the intra-grid areas.

The surveys will be conducted using a Ludlum 2221 and a 2 x 2 inch NaI gamma detector. The detector will be unshielded to provide for a broader screening area in assessing the surface survey. Values will be recorded in cpm. The maximum value will be recorded for each grid cell and all anomalously high areas (2 times background) will have the approximate limits designated on the survey data sheets. The locations will be marked in paint on the ground surface. Field screening data sheets will include recording the instrument serial number, calibration date, operator, and site grid coordinates surveyed. A copy of a field data sheet is attached (see Appendix H).

Locations with elevated gamma counts (twice background) will be marked to identify the limits of the elevated readings. Those areas that exceed the USEPA removal action level of 7.1 pCi/g total radium will be designated as Exclusion Zones. Work activities within the Exclusion Zones will be conducted in accordance with the procedures outlined in the HASP and are briefly summarized in Section 5.0.

Additional documentation of contaminant levels may be performed through the collection of samples for laboratory analysis using NUTRANL and/or high-resolution gamma spectroscopy analyses. Gamma spectroscopy samples will be collected in 500 ml Marinelli beakers and submitted to a subcontract laboratory for analysis. These samples may be collected to: a) document where removal is necessary; b) indicate areas where removal has been successful; or c) document areas that are below the USEPA removal action level as indicated by the NaI detector.

4.4 Pre-verification Surveys for Radiologically-Contaminated Areas

Pre-verification (confirmation) screening surveys will be conducted during the excavation of fill materials identified as radiologically-contaminated. Excavated locations will be screened in accordance with SOP-210 (Appendix E). Since evidence of radiologically-contaminated fill in excess of the 7.1 pCi/g removal action level has been identified, these areas will be designated as Exclusion Zones. As described in the Health and Safety Plan (HASP) and discussed briefly in Section 5.0, the Exclusion Zones will require appropriate PPE and personal air monitoring to enter. All equipment and personnel that enter an Exclusion Zone will need to be frisked clean upon leaving the Exclusion Zone. Personnel entering Exclusion Zones must be 40-hour health and safety trained. The surveys will be conducted using a Ludlum 2221 and a 2 x 2 inch NaI gamma detector.

During remediation of radiologically-contaminated materials, urban fill within Exclusion Zones that has not been documented as being below the removal action level will be surveyed in-place. Remediation excavation activities will proceed in lifts not to exceed 18 inches in thickness. If an increase in gamma radiation is noted on the order of twice background values, excavation will proceed in thinner lifts to minimize the potential for mixing clean and radiologically-contaminated fill. Excavation of contaminated material will proceed using an excavator with a maximum bucket volume of one cubic yard. This bucket size will facilitate loading the transport containers without spilling and spreading the radiologically-contaminated fill contamination. The subsample locations will be obtained by dividing the 100 m^2 area (10-meter x 10-meter) into four equal quadrants of 5-meters x 5-meters. Four of the subsamples will be collected from the center of the 5-meter x 5-meter quadrants. The fifth subsample will be obtained from the center of the 10-meter x 10-meter sample area. Sample collection will be in accordance with SOP-214.

Once the pre-verification screening indicates the absence of radiologically-contaminated material above the removal action level, fill or soil samples will be collected over a maximum 100 m^2 area for pre-verification analysis at a laboratory. Five subsamples will be composited to develop the sample for each 100 m^2 area. Analysis will be either by NUTRANL or gamma spectroscopy. After pre-verification analysis shows the area is less than the removal action level, the area will be subject to verification surveys and sampling by USEPA, in accordance with Section 4.5 of this Work Plan. The excavations will not be backfilled until a signed radiological verification closure form is received from USEPA.

Fill screening during the course of the remediation excavation activities is also intended to minimize the incorporation of clean material into materials which are designated for radiological disposal. Fill indicative of levels below 7.1 pCi/g total radium by the pre-verification screening process prior to excavation will be staged for potential use as backfill. As previously indicated, excavation conducted to remove radiologically-contaminated material will proceed using an excavator with a maximum 1 cubic yard bucket. This bucket size will also allow the excavated fill to be screened a second time, if necessary, before being placed on the backfill pile. This potentially non-contaminated fill may also be subject to verification surveys and sampling by USEPA, if requested, in accordance with SOP-214 (Appendix E) and Section 4.5 of this Work Plan.

Prior to the initiation of activities, gamma count rate background levels shall be established for each applicable survey instrument. Six locations shall be chosen in non-radiologically-contaminated areas of the Site. A one-minute integrated count shall be obtained at the surface of each location, for each survey instrument (Ludlum 2221 with 2” x 2” NaI probe). The measurements collected from each location shall be averaged to establish instrument specific background gamma count rates.

Excavated locations will be screened in accordance with SOP-210 (Appendix E). To demonstrate to the USEPA that the floors and sides of fill excavations meet removal action level criteria specified by USEPA, a verification/field sampling program must be implemented following the excavation of the radiologically-contaminated materials. The verification survey sampling program will be conducted in general accordance with SOP-223 and SOP-214 (Appendix E).

The excavations will not be backfilled until a signed radiological verification closure form is received from USEPA. Initial field demonstration that the location has been excavated to clean limits will be made with a shielded 2 x 2 inch NaI detector. Pre-verification samples will be collected and analyzed using NUTRANL software or gamma spectroscopy analyses. It is anticipated that both the NUTRANL software and gamma spectroscopy analyses will be conducted at an off-site (fixed) laboratory. Samples for high resolution gamma spectroscopy analysis will be taken to a subcontract laboratory operated by RSSI. If

utilized, NUTRANL results would be provided in two forms. The initial NUTRANL data set will consist of one set per sample and will include the radionuclide concentrations and error limits for uranium 238, thorium 232, radium 226, and potassium 40; the sample number; date and time sampled; laboratory number (sequential); identify the analyst; and analytic method (NUTRANL). The second lab data form will be a consolidated spreadsheet with all analysis in sequence by laboratory number. This table will include the sample number, data and time sampled, radionuclide concentrations and error limits for the four NUTRANL analytes, and a line totaling the thorium and radium concentrations. The laboratory will also maintain a copy of the chain-of-custody for those samples received and analyzed.

4.5 Verification Sampling

As previously indicated, fill exhibiting contamination above the removal action level of 7.1 pCi/g total radium (Ra-226 + Ra-228) will be removed, placed in transport boxes and shipped to a disposal facility licensed/approved to receive this material. Excavated locations will be screened in accordance with SOP-210 (Appendix E). To demonstrate to the USEPA that the floors and sides of fill excavations meet removal action level criteria specified by USEPA, a verification/field sampling program must be implemented following the excavation of the radiologically-contaminated materials. The verification survey sampling program will be conducted in general accordance with SOP-223 and SOP-214 (Appendix E).

The excavations will not be backfilled until a signed radiological verification closure form is received from USEPA. Initial field demonstration that the location has been excavated to clean limits will be made with a shielded 2 x 2 NaI detector. Pre-verification samples will be collected and analyzed using NUTRANL software or gamma spectroscopy analyses. It is anticipated that both the NUTRANL software and gamma spectroscopy analyses will be conducted at an off-site (fixed) laboratory. Samples for high resolution gamma spec analysis will be taken to a subcontract laboratory operated by RSSI.

If utilized, NUTRANL results would be provided in two forms. The initial NUTRANL data set will consist of one set per sample and will include the radionuclide concentrations and error limits for uranium 238, thorium 232, radium 226, and potassium 40; the sample number; date and time sampled; laboratory number (sequential); identify the analyst; and analytic method (NUTRANL). The second field lab data form will be a consolidated spreadsheet with all analysis in sequence by laboratory number. This table will include the sample number, data and time sampled, radionuclide concentrations and error limits for the four NUTRANL analytes, and a line totaling the thorium and radium concentrations. The field laboratory will also maintain a copy of the chain-of-custody for those samples received and analyzed.

Sample analysis should include analysis of quality control samples and reporting of their results. It is recommended that the laboratory use the U.S. Department of Energy Radiological and Environmental Sciences Laboratory (DOE RESL) performance evaluation standards that should be in either lab's possession; standard number RESL08095 specifically should be used. Evaluation of quality control sample results will be similar to that of RESL's Mixed Analyte Performance Evaluation Program (MAPEP), with performance flags assigned for each analyte of interest to EPA in this performance evaluation (Specifically Th-232/Ac-228 and the interpretation of Ra-226 concentration).

Flag	Meaning	Criteria for Radiological Analytes
"A"	Acceptable	Bias <= 20%
"W"	Acceptable with Warning	20% < Bias <= 30%
"N"	Not Acceptable	Bias > 30%

4.6 Materials Management

Two categories of urban fill material will be distinguished in the excavation process: Non-radiologically-contaminated fill suitable for backfill that does not exceed the removal action level of 7.1 pCi/g total radium, and excavated urban fill that is radiologically-contaminated in excess of the removal action level of 7.1 pCi/g total radium. There also may be materials that will be specified as unsuitable for backfill, based on engineering properties, non-radiological contamination, or other specifications.

4.6.1 Non-Radiologically Contaminated Material

Material from the Site that is not radiologically-contaminated at levels above the removal action level of 7.1 pCi/g total radium may be replaced in their original locations, placed in another location on the Site, salvaged (i.e., recyclable materials), or handled (i.e. fills delivered to a designated landfill) in accordance with applicable laws and regulations. No non-radiologically-contaminated materials (i.e., petroleum, etc.) are known to be present at the Site. However, materials that based on visual or olfactory observations are suspected to be contaminated by non-radiological contamination may be temporarily staged on-site to allow for proper sampling and characterization for disposal. These materials will be placed on liners and will be covered to minimize potential for erosion and spread of contamination.

Materials that are not radiologically-contaminated above the removal action level of 7.1 pCi/g total radium, and are designated to be removed from the Site, will be disposed of in accordance with applicable regulations as necessary.

4.6.2 Radiologically-contaminated Material

Radiologically-contaminated material excavated from the Site will be temporarily stored in super-sacks until final disposal arrangements can be completed. Stored fill will be properly secured with fencing and placarded with appropriate warning signs (i.e., similar to that utilized for Exclusion Zones).

Radiologically-contaminated materials will be transported to an approved disposal facility. At present, the facility is undetermined, but will be either EnergySolutions in Clive, Utah or US Ecology in Grand View, Idaho. Shipping and placarding will be in accordance with all Department of Transportation regulations. Permitting for disposal will be arranged before contaminated material is loaded for shipment. Radiologically-contaminated materials will be transported between the Site and the approved disposal facility according to DOT regulations. Procedures which will be used to minimize the potential for and effects of spills and accidents during transport of materials radiologically-contaminated above the removal action level of 7.1 pCi/g total radium include, but are not limited to, the following:

- Drivers will have the proper licenses, training, and certifications for transporting potentially radioactive materials.
- Trucks will carry all necessary papers and placarding. AECOM will inspect the bulk storage bags prior to loading to determine suitability for transport.
- If required, contaminated vehicles and equipment will be decontaminated first using broom cleaning to remove all adhering surface dirt. As needed, pressurized water spray will be used for further decontamination. Water generated during decontamination will be contained and evaporated, used for dust control on contaminated fill designated for disposal, or possibly sent for disposal at an approved disposal facility.
- Prior to transporting radiologically-contaminated excavated fills or other materials, all transport equipment will be frisked if there is reason to believe they may have come in contact with contaminated material. Frisking will include tires and fenders and the sides and back of the bed. Frisking the cabs of trucks will not be necessary unless loading has been over the front of the truck.

Soil or fill that, based on visual or olfactory observations, is suspected to be contaminated by non-radiological contamination will be temporarily staged on-site to allow for proper sampling and characterization for disposal. These materials will be placed on liners and will be covered to minimize potential for erosion and spread of the material.

4.7 Data Management and Report

Data management for the site consists of site safety and training records, health physics data (i.e., air monitoring and personnel monitoring data), soil radioactivity field and laboratory data, shipping and

transport records, and civil construction and excavation data (i.e., land surveys, excavation volume estimates, etc.). A local laboratory will be used to analyze soil samples as excavation and removal proceeds, and for pre-verification sampling to demonstrate the removal action level has been met. Analytical records will be kept at the site and at the AECOM office in Chicago, Illinois. Air monitoring analyses will be maintained at both the site and the AECOM office, and will be transmitted with the monthly project progress reports to USEPA.

Monthly progress reports will be submitted to USEPA beginning 30 days after initiation of the field work, and will be submitted monthly by the 15th of each month until submission of the Closure Report document, unless otherwise directed by the USEPA On-Scene Coordinator (OSC). These monthly reports will describe all significant developments during the preceding period, including the work performed, and any problems encountered, analytical data received during the reporting period, and developments anticipated during the next reporting period, including a schedule of work to be performed, anticipated problems, and planned resolutions.

4.8 Exclusion Zone Access and Security

Access by unauthorized personnel to the Exclusion Zone excavation areas will be controlled during operational and non-operational hours because of hazards created by open excavations, moving contractors' equipment, and traffic. Only authorized personnel will be permitted within the fenced area. Exclusion Zone access will be directed by the Project Coordinator, Field Team Leader or their designated representative (see HASP). The excavation work area will be fenced with a temporary chain-link fence unless the access is restricted by fencing at the site perimeter. In the case of a perimeter fence, access to the excavation areas will be restricted through the use of temporary fencing (i.e., plastic barrier fencing). This fencing will include appropriate signage to provide security during non-operational hours. Access gates/points will be closed when not in use.

During operational hours, the project management consultant, its contractors and subcontractors, and their representatives will have access to the excavation area to implement the excavation activities. The party responsible for radiological materials transport and their contractors and subcontractors will have access to implement health physics and transportation activities. Information on restrictions to the excavation areas, and various signs and barricades, will be disseminated during the project kick-off meeting held at the beginning of the project.

All visitors desiring access to the excavation area will be required to register with the Project Coordinator or his designee. The Project Coordinator or his designee will provide necessary orientation and training,

provide radiation monitors as appropriate, and escort the visitors. The visitors will be required to observe all health and safety requirements and follow all instructions given by the Field Team Leader.

Regulatory and governmental officials who visit the excavation areas regularly will be requested to notify the Project Coordinator or the Field Team Leader. They will be required to comply with all Health and Safety rules.

During non-operational hours, barricades, beacons, warning signs, and temporary fencing, as appropriate, will be placed to prevent unauthorized entry into an Exclusion Zone. Exclusion Zones will be surrounded with magenta and yellow rope and stakes or fence posts until determination that it meets the USEPA removal action level. Signs will be placed on the excavation area perimeter fencing identifying the area as a construction area and prohibiting unauthorized entry. The warning signs will be installed at maximum 100 foot intervals on the perimeter fence.

4.9 Decontamination

All discarded materials, waste materials, and other field equipment and supplies shall be handled in such a way to prevent the potential spread of contamination during excavation and restoration activities. Discarded items that have contacted contaminated materials will be containerized and stored for disposal at the approved disposal facility. Non-contaminated items to be discarded will be collected for disposal as general refuse waste. Personnel and sampling equipment decontamination are described in the Decontamination Procedure included as SOP-347 of Appendix E.

4.10 Temporary Storage of Radiologically-Contaminated Material

As per discussion with the USEPA, there may be a need for temporary on-site storage of radiologically-contaminated materials. Projects previously conducted in Streeterville have involved Tronox in the transportation and disposal of the radiologically-contaminated fill. If discovered, it is anticipated that radiologically-contaminated fill will be staged temporarily on-site in bulks storage containers (bags) until the remediation efforts are complete or sufficient volume has been staged for transportation. Stored fill will be properly secured with fencing and placarded with appropriate warning signs (i.e., similar to that utilized for Exclusion Zones)

5.0 HEALTH AND SAFETY PLAN (HASP) SUMMARY

Site surveys, excavation and remediation activities will be conducted in accordance this Work Plan and the enclosed USEPA Streeterville HASP. The HASP is provided in Appendix I. Additionally, reference is made to the following documents included within Appendices:

- Dust Control Plan
- SOP-210 – Gamma Radiological Surveys
- SOP-217 – Excavation Procedure
- SOP-223 – Verification Survey Procedure
- Construction Health and Safety

The Streeterville HASP addresses required training, personnel protection equipment, general work precautions, and medical monitoring among other issues. In general, as contamination is detected, either by the initial surface survey or in the course of monitoring the excavations, the areas will be designated with a magenta and yellow rope and stakes or fence posts. These areas will be designated Exclusion Zones, and will require appropriate PPE and personal air monitoring to enter. All equipment and personnel that enter an Exclusion Zone will need to be frisked clean upon leaving the Exclusion Zone. Personnel entering Exclusion Zones must be 40-hour health and safety trained.

All accidents or injury "near misses" will be documented and communicated to the Project Coordinator and Field Team Leader in a timely manner. Project safety briefings will be held on a weekly basis, and a project tailgate meeting will be held on a daily basis as a regular part of project communication between the Field Team Leader and project contractors and subcontractors.

5.1 Key Personnel

While health and safety will be the concern of every person on the job, the radiation survey and excavation management team will be responsible for the implementation of the HASP. These persons are the Project Coordinator, Health and Safety Officer and the Field Team Leader. Figure 4 presents the project management work organization chart. The responsibilities for these positions are detailed in the HASP. Radiation laboratory subcontract services will be provided through Stan A. Huber and Assoc. or RSSI.

5.2 Potential Hazards

Potential hazards that could be encountered during the removal activities include contaminated materials and the hazards associated with construction work. Contaminants of concern include the entire decay series for U-238 and Th-232. Radiological and air monitoring as described in this Work Plan will be performed during excavation to define the presence of radiological contaminants.

The mechanisms for exposure to the radiologically-contaminated fill material are direct exposure, inhalation, ingestion and eye/skin contact. The primary mechanism of exposure is direct exposure to external gamma radiation. All workers will be instructed in appropriate measures to protect against exposure to the above materials, and PPE will be worn until monitoring shows such is not necessary.

Physical hazards which might be encountered at this site include but are not limited to the following:

- Construction equipment (front-end loaders, back-hoes, trucks, compactors, bulldozers);
- Power tools (saws, drills, jack hammers, compactors);
- Heat and cold stress;
- Overhead power lines;
- Excavations;
- Confined space;
- Noise;
- Demolition of structures;
- Slip, trip and fall conditions, especially during wet or freezing periods; and
- Buried utilities.

For this project, “utilities” include natural gas, water, sewer, communication, cable television lines, and electrical power distribution systems. Prior to the physical site survey, city and utility company records concerning location and construction of utilities on and in the general vicinity will be reviewed and consolidated on a single Utility Plan Drawing. The appropriate utility companies or their designees will be asked to verify the location by originating a request through the Chicago Utility Alert Network (DIGGER) phone number: 312-744-7000, and through application to the Office of Underground Coordination (OUC).

The locations of the identified utilities will be “ground-truthed” by observing the locations of power and phone poles, above-ground transformers (where electrical distribution lines are below ground), manholes, water meters, natural gas meters, phone boxes, surface indications such as utility vaults, catch basins, and surface depressions which can occur over utility trenches, and the locations marked by the utility companies or their representatives. Procedures for working in the vicinity of utilities and repair to

damaged utilities will be discussed with the excavation contractor crews. All work on and in the vicinity of utilities will be in accordance with City and utility company specifications.

Additional details on these and other safety provisions are addressed in the HASP.

5.3 Training and Communications

Site and project specific radiation and health and safety training will be provided for all on-site personnel prior to work on the Site. All personnel required to work in the Exclusion Zone or Contamination Reduction Zone shall complete training conforming to the requirements of 29 CFR 1910.120(e) including 40 hours of initial hazardous waste site worker training. Where appropriate, they shall have 8 hours of annual refresher training, and 8 hours supervisors training. Field personnel involved in remediation activities shall complete radiation safety training in compliance with 32 IAC 400. This training shall include, at a minimum, 4 hours of training pertaining to radiation safety and awareness. Training will be conducted by a qualified safety specialist and/or a qualified senior health physics technician, at a minimum. The project training program is included in HASP. As noted in the HASP, Federal safety requirements take precedence over state requirements.

All site personnel will be trained and briefed on radiation basics, anticipated hazards, equipment to be worn, safety practices to be followed, contamination prevention practices, emergency procedures, radiation basics and communications. Procedures for leaving a contaminated area shall be planned and implemented prior to going on-site. Work areas and decontamination procedures will be established based on expected site conditions, and updated as necessary during construction. Other guidelines such as heat and cold stress, excavation safety and confined space are included within the HASP.

In addition to this formal health and safety training, “tailgate” safety meetings will be held weekly, or more frequently, dependent on safety issues arising during the project. These meetings may be led by the worker's foremen and every employee must sign in before beginning work for the week. The subject covered and persons present will be recorded for each meeting and kept as part of the project records. Health and safety incidents and monitoring results will be discussed in the tailgate safety meetings, when appropriate.

Visitors to the site will be briefed on the requirements of the HASP before being allowed within the work area, and will be accompanied by a foreman or supervisor whenever possible.

5.4 Personnel Protective Equipment

If radiologically-contaminated fill removal is necessary, all personnel operating in Exclusion Zones will be required to have personal air monitors (PAMs). Disposable coveralls, steel-toed work shoes, boot covers, hard hat, safety glasses and gloves will also be required in all Exclusion Zones. Prior to exiting any Exclusion Zones, personnel will go through decontamination, disposal of all appropriate PPE, and frisking procedures as described in the HASP.

5.5 Air Quality Monitoring

The principal objectives of the air monitoring activities are to:

- Ensure worker and general population safety and provide radiological control information;
- Evaluate work procedures and site control measures. In addition to identifying the need for corrective action, air monitoring also documents the effectiveness of such control actions; and
- Measure releases of airborne radioactivity (should any occur) and ensure that people living and working in the surrounding area are not exposed to radiation above acceptable limits.

A primary requirement of dust control is “no visible dust” during activities associated with contaminant removal. The excavation (remediation) and fill handling areas where contaminated fill is present will be required to have no visible dust. Fugitive dust generation is caused by a range of activities including excavation, loading, dumping, transporting and scraping using heavy equipment such as bulldozers, front-end loaders, trucks and graders.

Air monitoring is generally conducted for the purpose of documenting and, if detected, initiating measures to control airborne contamination. High volume air sampling equipment has been used in the past for large-scale remediation efforts in Streeterville and has not indicated an issue. Therefore, it is apparent that control measures are appropriate for controlling fugitive dust issues and high volume air sampling provides little or no benefit on this project. As stated previously, the presence of radiologically-contaminated material at the Site has not been confirmed. If the volume of contaminated fill that will be excavated is minimal (measured in yards rather than hundreds of yard), the potential to create a fugitive dust issue is reduced significantly and a request to USEPA will be made to limit air monitoring potentially to just personal exposure monitoring.

During the excavation and handling of radiologically-contaminated materials, the procedures to be followed to control dust will include traffic speed control and use of covered stockpiles. Excavated radiologically-contaminated fill above the Removal action level of 7.1 pCi/g total radium will be loaded directly into the super sacks as the material is excavated. Radiologically-contaminated material stored

on-site will be stored in super-sacks. Stockpiled uncontaminated materials, including excavated and imported borrow material, will be piled (height limited) to minimize dust generation. If these initial efforts appear to be inadequate to control dust, water will be applied during the course of excavation and restoration activities as directed by the Field Team Leader to prevent, mitigate or reduce dust resulting from excavation activities. The Dust Control Plan (Appendix F) provides additional detail on the control measures that may be implemented, if necessary, at the Site.

5.5.1 Personal Exposure Monitoring

Personnel operating in Exclusion Zones will be required to have personal air monitors (PAMs). Procedures for personal air monitoring are discussed in the HASP and SOP-212 (Appendix E). Lapel samplers worn for personal air monitoring will be utilized for airborne radioactivity monitoring. Air filters will be analyzed on a daily basis and additional evaluation of samples will be performed when determined necessary based on elevated results. Procedural changes or control measures, such as wetting of fill, will be employed prior to the prescription of respiratory protective equipment.

6.0 CLOSURE DOCUMENTATION

An objective of the Work Plan is to document the identification, handling, and disposal of radiologically-contaminated fill encountered during construction activities at the Site. The following types of data will be generated during the project:

- Surface gamma survey records
- Fill or soil sampling records
- Sample field laboratory data
- Fixed laboratory fill analyses data (USEPA contract and AECOM subcontract laboratories)
- Air quality sampling records
- Air quality analytical data

The results of the Work Plan investigation and the removal work will be presented in a final closure report. The closure report will provide a summary of the locations of contaminated material identified during the project, areas remediated, a drawing of uninvestigated areas (if any), and identify any known areas where contaminated fill remains on-site. The report will include field data summaries, laboratory results, documentation of the volume of material removed and its disposal location. The report will present the information as the basis for and will request issuance by USEPA of a “Certification of Completion Letter” for the Site. The final closure report will be submitted within 60 days of completion of the removal work and on-site investigations.

7.0 REFERENCES

STS (October 2, 2007) Parcel 1 Completion Report – 400 East Illinois Street, Chicago Illinois, STS Project No, 1-27313-XC.

STS (May 12, 2005) Work Plan for Pre-Construction Radiation Screening, ParkView West Development, Northwest Corner of North Peshtigo Court and East Illinois Street, Chicago Illinois, STS Project No, 1-27313-XC.

STS (April 12, 2002) Phase I ESA at Parcels 21 and K, Chicago Illinois, STS Project No, 1-24418b-YB.

STS (April 4, 2002) Phase I ESA at Parcels 21 and K, Chicago Illinois, STS Project No, 1-24418a-YB.

STS (November 20, 2000) Radiological Survey of the Three Parking Lots in the Vicinity of the Former Kraft Building, Chicago Illinois, STS Project No, 1-24418-XO.

STS (August, 1992) Northwestern Memorial Hospital New Site Investigation, Columbus Drive and Grand Avenue, Chicago Illinois, STS Project No, 1-27313-XH.

URS (October 6, 2003) Letter Report Update of Phase I Environmental Site Assessment of Parcel K, Chicago Illinois, URS Project No. 52603-007-007.

URS (September 30, 2003) Letter Report Update of Phase I Environmental Site Assessment of Parcel 21, Chicago Illinois, URS Project No. 52603-004-007.

URS (July, 2003) Gamma Detection Survey and Soil Sampling, Kraft Building North Parking Lot, Peshtigo Court, Chicago Illinois.

USEPA (May 17, 2005) Comments on the Work Plan for Pre-Construction Radiation Screening, ParkView West Development, Chicago, Illinois.

USEPA (March 23, 2001) Radiation Survey, 26-Acre Site, Southwest Corner of Wacker Drive and Lake Shore Drive, Chicago Illinois.

USEPA (November 13, 2000) Geotechnical Radiation Survey, 26-Acre Site, Southwest Corner of Wacker Drive and Lake Shore Drive, Chicago Illinois.

USEPA (October 17, 2007) Completion of Work Under Docket No. V-W-05-C-834 for Parcel 1 of Lindsay Light II Site OU10, 400 East Illinois, Chicago Illinois.

Appendix A

Plat of Survey

GREMLEY & BIEDERMANN

A DIVISION OF

PLCS Corporation

LICENSE NO. 184-005322

PROFESSIONAL LAND SURVEYORS

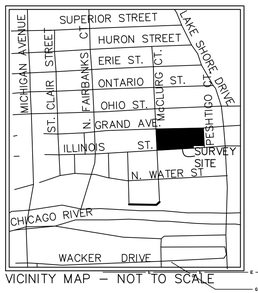
4505 NORTH ELSTON AVENUE, CHICAGO, IL 60630

TELEPHONE: (773) 685-5102 FAX: (773) 286-4184 EMAIL: INFO@PLCS-SURVEY.COM

PLAT OF SURVEY

BLOCK 3 (EXCEPT THAT PART THEREOF DEDICATED FOR SIDEWALK) IN CITYFRONT CENTER, BEING A RESUBDIVISION IN THE NORTH FRACTION OF SECTION 10, TOWNSHIP 39 NORTH, RANGE 14, EAST OF THE THIRD PRINCIPAL MERIDIAN, ACCORDING TO THE PLAT THEREOF RECORDED FEBRUARY 24, 1987 AS DOCUMENT 87106320, IN COOK COUNTY, ILLINOIS.

125,477 SQ. FT. OR 2.88 ACRES MORE OR LESS.



VICINITY MAP – NOT TO SCALE

THE CITY OF CHICAGO BOARD OF UNDERGROUND INVOLVEMENT HAS BEEN REQUESTED FOR YOUR SURVEY. THE RESULTS TO DATE ARE INDICATED BELOW. AS A CONVENIENCE TO YOU THE UTILITY DATA IS REVIEWED AND ADDED TO THIS PLAT AS IT IS RECEIVED. THESE RECORDS ARE THEN FORWARDED TO YOU. PLEASE BE AWARE THAT NO OTHER COPY OF THIS INFORMATION IS RETAINED.

OUPS# 2014-60870

X - INVOLVED . N - NOT INVOLVED. BLANK - NOT RECEIVED.

- X 1. AT&T-ILLINOIS/SBC
- X 2. AT&T LOCAL NETWORK SERVICES
- X 3. BUREAU OF ELECTRICITY
- X 4. CDOT - PROJECT DEVELOPMENT
- X 5. CDOT RED LIGHT CAMERAS
- X 6. BUREAU OF FORESTRY
- X 7. CDOT ENGINEERING
- X 8. CTA - TRAFFIC
- X 9. CTA - ENGINEERING
- X 10. RCN METRO OPTICAL NETWORKS - CHICAGO
- X 11. CHICAGO PARK DISTRICT
- X 12. COMED TRANSMISSION
- X 13. DEPARTMENT OF WATER MANAGEMENT - SEWER SECTION
- X 14. CDMW WATER SECTION CONSULTANT
- X 15. MCI
- X 16. M. W. R. D.
- X 17. PEOPLES GAS
- X 18. ABOVENET COMMUNICATIONS
- X 19. COMCAST
- X 20. JCDECAUX NORTH AMERICA
- X 21. DIGITAL REALTY TRUST (LAKESIDE TECHNOLOGY CENTER)
- X 22. LEVEL 3 COMMUNICATIONS / LGN
- X 23. MDE/THERMAL CHICAGO CORPORATION
- X 24. COMED - DISTRIBUTION
- X 25. CDOT - DIVISION OF ELECTRICAL OPERATIONS
- N 26. SUNESYS, LLC.
- N 27. SIDERA NETWORKS

Legend:

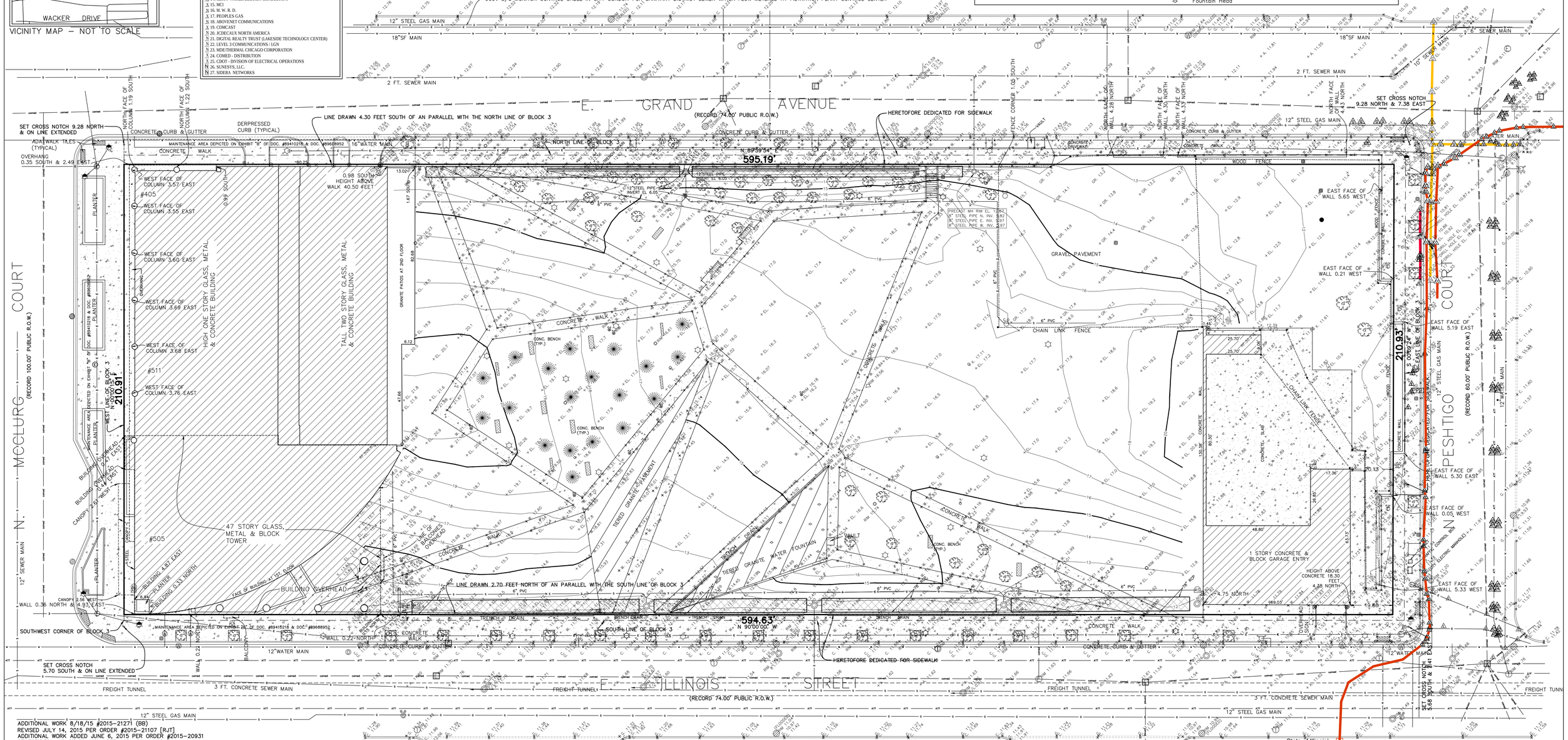
Storm MH	Telephone Vault	Electric Traffic Signal	Tree – Deciduous
Storm CB	Telephone Pedestal	Electric Light Pole with Traffic Signal	Tree – Evergreen
Storm Inlet	Public Telephone	Electric Traffic Control Box	Parking Meter
Storm Inlet	Combination Pedestal	Electric Traffic Vault	Parking Pay Box
San MH	Utility Pole	Electric Ground Light	Sign Post
San Storm Combo MH	Guy Anchor	Electric Mounted Wall Light	Mail Box
San Clean Out	Electric Manhole	Gas Buffalo Box	Bumper Post
Water Valve Vault	Electric MH	Gas Hand Hole	Bike Rack
Water MH	Electric Vault	Gas Meter	Soil Boring
Water Buffalo Box	Electric Hand Hole	Gas Valve	Unclassified Manhole
Water Hand Hole	Electric Pad	Gas MH	Auto Sprinkler
Water Meter	Electric Meter	Gas Vault	Hose Connection
Water Fire Hydrant	Electric Pedestal	Cable TV Pedestal	Fire Alarm
Telephone MH	Electric Light Pole	Electrical Box	Flag Pole
		Fountain Head	

GRAPHIC SCALE

20 0 10 20

(IN FEET)
1" = 20'

J.U.L.I.E. MARKS FOUND	J.U.L.I.E. LINES
ELECTIC	
GAS	
COMCAST	
AT&T	



ADDITIONAL WORK 8/18/15 #2015-21271 (BB)
REVISED JULY 14, 2015 PER ORDER #2015-21107 [RJT]
ADDITIONAL WORK ADDED JUNE 6, 2015 PER ORDER #2015-20931
RECERTIFIED AUGUST 26, 2014 PER JOB #2014-19813
BOARD OF UNDERGROUND ADDED AUGUST 6, 2014
REVISED MAY 14, 2014 ADD UNDERSIDE ELEV PG2 [BSS]
REVISED MAY 2, 2014 ADD TREE SZ/CTRS [BSS]

ORDERED BY: RELATED MIDWEST	CHECKED: PG	DRAWN: BSS
ADDRESS: PARKVIEW EAST - CHICAGO, IL		

GREMLEY & BIEDERMANN
A Division of PLCS CORPORATION
License No. 184-005322
PROFESSIONAL LAND SURVEYORS
4505 NORTH ELSTON AVENUE, CHICAGO, IL 60630
TELEPHONE: (773) 685-5102 FAX: (773) 286-4184 EMAIL: INFO@PLCS-SURVEY.COM

ORDER NO.	DATE:	PAGE NO.
2014-19179-001	APRIL 30, 2014	1 OF 2
	SCALE: 1 INCH = 20 FEET	

G:\CAD\2014\2014-19179\2014-19179-001.dwg

REVISED: 8/26/15 PER #2015-21271 [RJT]

ELEVATIONS SHOWN HEREON ARE REFERENCED TO CHICAGO CITY DATUM (C.C.D.)

BENCHMARK # 4358
ELEVATION = 13.652 C.C.D.

LOCATION: SW COR. N. LAKE SHORE DR. & E. OHIO ST. MARK CUT NEAR NW COR. CONC. LEDGE, N. SIDE MULTI-STORY BRICK BLDG. 14.1' W. OF NE COR. ABOUT S. LINE E. OHIO ST.

A.=ASPHALT ELEVATION
GR.=GRAVEL ELEVATION
FFE.=FINISHED FLOOR ELEVATION
W.=WALK ELEVATION
X.=CONCRETE ELEVATION
TOE.=TOP OF SLOPE ELEVATION
TOB.=TOP OF BANK ELEVATION
C.=CURB ELEVATION
G.=GUTTER ELEVATION
EL.=ELEVATION

I.=INVERT
F/L.=FLOW LINE
TP.=TOP OF PIPE
TV.=TOP OF VALVE
BOT.=BOTTOM
NVP=NO VISIBLE PIPE

SURVEY NOTES:

PROPERTY APPEARS IN "OTHER AREAS" ZONE X, AREAS DETERMINED TO BE OUTSIDE THE 0.2% ANNUAL CHANCE FLOODPLAIN, PER FLOOD INSURANCE RATE MAP COOK COUNTY, ILLINOIS, MAP NO. 17031C0438J, EFFECTIVE DATE AUGUST 19, 2008.

Note R. & M. denotes Record and Measured distances respectively.

Distances are marked in feet and decimal parts thereof. Compare all points BEFORE building by same and at once report any differences BEFORE damage is done.

For easements, building lines and other restrictions not shown on survey plat refer to your abstract, deed, contract, title policy and local building line regulations.

NO dimensions shall be assumed by scale measurement upon this plat.

Unless otherwise noted hereon the Bearing Basis, Elevation Datum and Coordinate Datum if used is ASSUMED.

SURVEY NOTES:

UTILITY WARNING

The underground utilities shown have been located from field survey information and existing drawings. The surveyor makes NO guarantee that the underground utilities shown comprise all such utilities in the area, either in service or abandoned. The surveyor further does not warrant that the underground utilities shown are in the exact location indicated although he does certify that they are located as accurately as possible from information available. The surveyor has not physically located the underground utilities.

Call DIGGER - (312) 744-7000 within the City of Chicago.

Outside of the City of Chicago call J.U.L.I.E. (800) 892-0123 prior to construction or excavation.

State of Illinois)
County of Cook)ss

We, GREMLEY & BIEDERMANN, INC. hereby certify that we have surveyed the above described property and that the plat hereon drawn is a correct representation of said survey corrected to a temperature of 62° Fahrenheit.

Field measurements completed on AUGUST 18, 2015.

Signed on Sept. 16, 2015.

By: Robert G. Biedermann

ROBERT G. BIEDERMANN 2002 PROFESSIONAL LAND SURVEYOR STATE OF ILLINOIS CHICAGO, ILLINOIS

Professional Illinois Land Surveyor No. 2802
My license expires November 30, 2016
This professional service conforms to the current Illinois minimum standards for a boundary survey.

Appendix B

USEPA Completion Letter - October 17, 2007

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

REPLY TO THE ATTENTION OF:

October 17, 2007

SE-5J

VIA FACSIMILE NO. (847) 279-2510 AND U.S. MAIL

Mr. Charles Landefeld
MCL CDC P21 L.L.C.
455 East Illinois Street
Chicago, Illinois 60611

RE: Completion of Work under AAOC Docket No. V-W-05-C-834 for Parcel 1 of the Lindsay Light II Site OU10, 400 East Illinois (fka 510 North Peshtigo Court/Kraft), Chicago, Illinois

Dear Mr. Landefeld:

On December 5, 2005, the United States Environmental Protection Agency (U.S. EPA) entered into an Administrative Agreement and Order by Consent (AAOC) Docket Number V-W-05-C-834 with MCL CDC P21, LLC (MCL), in which MCL agreed to perform specified activities, including soil screening, removal and other activities, (the "Work") at the former Kraft property located at 400 East Illinois, Chicago, Illinois (Site), and to reimburse U.S. EPA for response costs associated with this Site. U.S. EPA and MCL entered into the AAOC because an Action Memorandum documented U.S. EPA's determination that radioactive materials present at the Site required a time-critical removal action based on the impending development of the Site.

The terms of the AAOC provided that if MCL did not radiologically investigate the entire Site or remediate thorium contamination from the entire Site, then MCL would establish U.S. EPA-approved institutional controls to control exposure to and release of thorium contamination. Pursuant to the AAOC, MCL submitted a work plan that U.S. EPA approved on December 5, 2005 and then MCL initiated site work on January 4, 2006. During the performance of the work, MCL identified several areas of potential and confirmed contamination in the rights-of-ways along North McClurg Court and East Grand Avenue, over which the City of Chicago has jurisdiction and holds in trust for the public. Those rights-of-ways are depicted on the enclosed Figure 4, Site Plan Showing Locations of Impacted Material Remediations, Parcel 1 and Parcel 2, Chicago, Illinois. MCL has agreed to provide the City of Chicago with copy of Figure 4 as contemplated by the Right-of-Way Agreement dated September 27, 1999 (Right-of-Way Agreement). The Right-of Way Agreement was entered into by City of Chicago, Kerr McGee Chemical LLC and River East LLC. and recorded at the Cook County Recorder of Deeds, document number 99924673.

As the investigation and cleanup work progressed, MCL proposed to divide the Site into two Parcels designated as Parcel 1 and Parcel 2, for purposes of remediation and issuance of a Completion Letter. (See the enclosed Figure 4 Site Plan.) MCL further informed U.S. EPA that MCL had decided to investigate and remediate the entirety of the Parcel 1 portion of the Site. Therefore, institutional controls were not required for the Parcel 1 portion of the Site. If MCL does not radiologically investigate and remediate, as necessary, the entirety of Parcel 2, then institutional controls shall be established on Parcel 2.

On October 2, 2007, MCL submitted a Final Report meeting the requirements of Paragraph 20 of the AAOC and documenting completion of the Work as required by the AAOC for Parcel 1. The October 2, 2007 Final Report includes documentation that Tronox LLC shipped approximately 2,000 cubic yards of thorium impacted soil removed from the Site to Energy Solutions Clive Facility (fka Envirocare) in Clive, Utah, a disposal facility licensed to accept radioactive waste, in accordance with Paragraphs 20 and 21 of the AAOC. Based upon the Final Report and U.S. EPA's inspections of the Site and past oversight of the Work, U.S. EPA concludes that MCL has completed the Work required by the AAOC Section VIII, for the Parcel 1 portion of the Site. No institutional controls are required for property within the legal boundaries of the Parcel 1 portion of the Site.

The suspected and confirmed contamination in the McClurg Court and East Grand Avenue rights-of-ways, however, remain subject to the Right-of-Way Agreement institutional controls.

As stated above, this letter merely reflects U.S. EPA's determination in accordance with Paragraph 72 of the AAOC that MCL has completed the Work required by the AAOC for Parcel 1, including the removal of all radioactive materials found at Parcel 1 of the Site. This letter does not apply to any other portion of the Site. This notice of completion in no way releases MCL from any potential future obligations to perform additional work to address the same, or other, conditions at the Parcel 1 portion of the Site should such work be the subject of a future U.S.EPA Administrative Order. Similarly, this notice of completion does not release MCL from any recordkeeping, payment (including payment of certain response costs in accordance with Paragraph 40 of the AAOC) or other obligations under the AAOC that extend beyond the date of this notice.

Please contact me at (312) 886-3601 and direct any legal inquiries to Mary Fulghum, Associate Regional Counsel at (312) 886-4683 or Cathleen Martwick, Associate Regional Counsel at (312) 886-7166, if you have any questions concerning this letter.

Sincerely,

Charles Nelson FOR V.S.

Verneta Simon
On-Scene Coordinator

Enclosure

cc: Dr. Steven Komder, STS Consultants, Ltd.
Vincent S. Oleszkiewicz, Esquire, Duane Morris LLP, w/enclosure

DM2\1247205.3

Appendix C

May 2005 Down-Hole Radiation Screening Results

Table 1
Summary of Down-Hole Gamma Measurements
Parcels K and 21, Chicago Illinois

Boring Number	Depth Below Ground Surface (ft)	Total Radium[1] (pCi/gm)	Maximum Counts (30 seconds)	30 sec. Count Equivalent to 7.1 pCi/gm*
B-1	1 1/2	-	**8,086**	7,633
B-2	3 1/2	-	**7,749**	
B-3	4 1/2	2.75[a]	**30,238**	
B-4	5	-	3,774	
B-5	6	-	**8,321**	
B-6	4	-	**10,597**	
B-8	4 1/2	-	4,124	
B-9	4 1/2	-	3,944	
B-10	5	-	**11,574**	
B-12	4 1/2	-	4,621	
B-13	9 1/2	-	5,457	
B-15	9 1/2	-	3,175	
B-16	2 1/2	-	4,027	
B-17	1	-	3,285	
B-18	7	-	3,437	
B-20	10 1/2	-	4,949	
DH-1	1	140[b]	**83,222**	
DH-2	4	-	5,573	
DH-3	6	-	4,615	
DH-4	11.5	-	3,058	

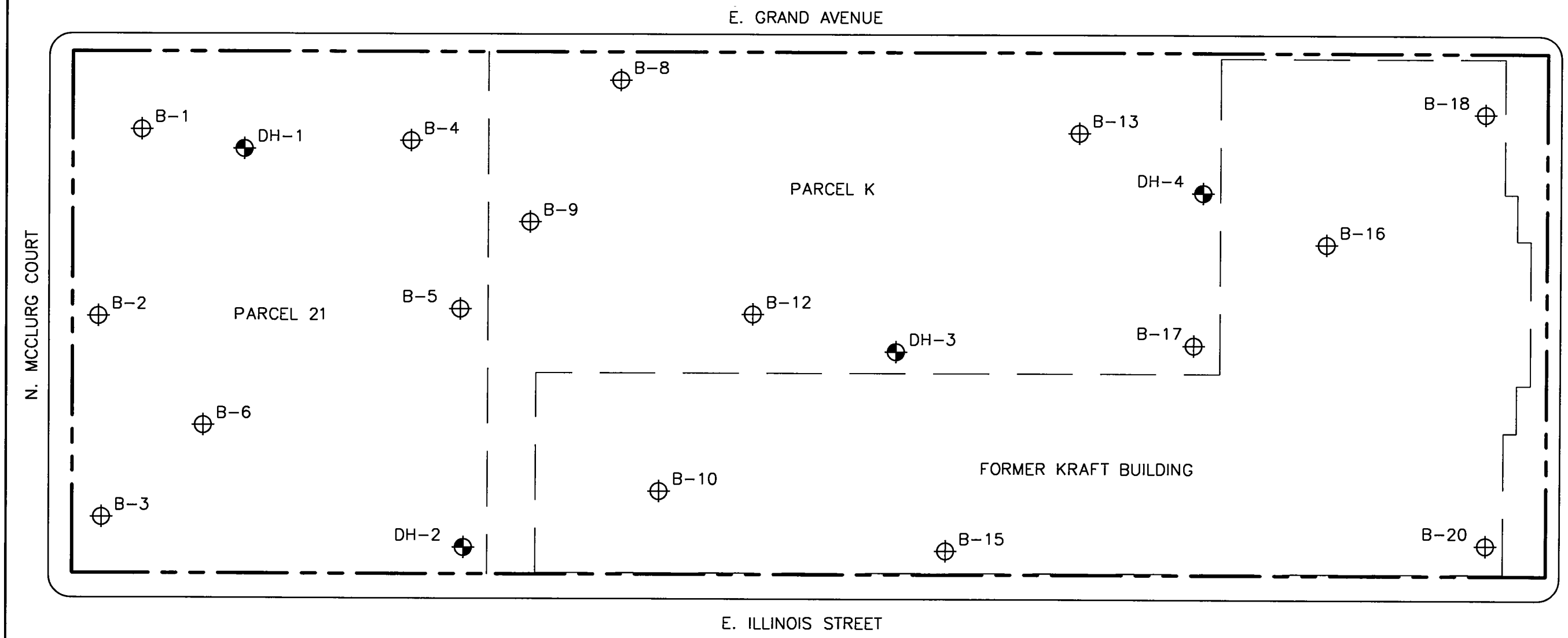
Notes:

* Counts equivalent to 7.1 pCi/gm, Ludlum Model 2221, Serial No. 172039.
All gamma measurements recorded with the probe in a sheilded mode.

1 - Pb-214 and Bi-214 average used as surrogate for Ra-226, Ac-228 used as surrogate for Ra-228.

a - Soil sample obtained from a depth of 0.5 - 1.0 ft. at 11:30 on 5/20/05.

b - Soil sample obtained from a depth of 4.0 - 5.5 ft. at 15:00 on 5/18/05.



LEGEND

- BORINGS WITH OFFICE OF UNDERGROUND CLEARANCE
- BORINGS LIMITED TO DEPTH OF 12 FEET

N

0 50

1" = 50'

STS CONSULTANTS
750 Corporate Woods Pkwy.
Vernon Hills, IL 60061
847-279-2500
www.stsconsultants.com

SITE PLAN SHOWING LOCATIONS OF DOWN-HOLE RADIATION SURVEY

PARCEL K AND PARCEL 21

Drawn:	BWS	08/18/2005
Checked:	SCK	08/18/2005
Approved:	SCK	08/18/2005
PROJECT NUMBER	1-27313-XC	
FIGURE NUMBER	2	

Appendix D

Environmental Investigation Gamma Results - July 2015

AECOM
100 S. Wacker Drive, Suite 500
Chicago, Illinois 60606

312-939-1000 tel
312-939-4198 fax

September 8, 2015

Ms. Megan Wells-Paske
Senior Project Manager
Pioneer Environmental Services, LLC
700 North Sacramento Blvd., Suite 101
Chicago, IL 60612

RE: Radiological Survey of Environmental Borings
Address: 451 East Grand Avenue and 456 East Illinois Street
AECOM Project No.: 60442737

Dear Ms. Wells-Paske:

Pursuant to conditions specified in a permit (attached) issued by the City of Chicago, radiation monitoring of disturbed fill soils was required to be performed at the above referenced site. AECOM Technical Services, Inc. (AECOM) provided the required radiation surveillance on July 1 and 2, 2015 for ten (10) environmental borings performed at 451 East Grand Avenue and 456 East Illinois Street (also known as Parcel 2 of the former Kraft Lot).

Surveying was performed on soil samples removed from 10 environmental borings (B-1 through B-10) and the drilling spoils of one monitoring well installed at location B-8 (refer to Figure 1). Copies of the boring logs are also attached. The urban fill found in the Streeterville area typically consists of loose brown-black fine to medium sands with bricks, glass, scrap metal, cinders, concrete, etc. The average depth of the urban fill for site based on the original 2006 investigation was 8-10 feet, while borings within the former foundation indicated 10 to 15 feet of fill dominated by crushed brick and concrete which was characteristic of demolition debris from the former Kraft building.

Spoil and samples from each of the 2015 borings were surveyed for radiological contaminants. Based on historical drawings for the building footprint, the majority of the borings were located within the former Kraft building. Information for the demolition also indicated that the former basement slab was left in-place and backfilled with demolition debris from the building. Based on the refusal (refer to Table) only borings B-1 and B-6 appeared to be located outside of the former building foundation. The depth of urban fill at borings B-1 and B-6 was 15 and 10 feet, respectively. Boring B-1 is located within an area previously gamma screened during the original 2006 project. Boring B-1 is also located in close proximity to the garage wall. Thus, the deeper depth of fill soil at B-1 is attributed to excavation and backfilling of previously surveyed fill soil associated with the garage wall construction.

The gamma monitoring revealed no indication of fill soil above the clean-up value established by the U. S. Environmental Protection Agency (USEPA) for the Streeterville area of Chicago. The USEPA cleanup value for Chicago's Streeterville area is 7.1 picocuries per gram (pCi/g) total radium (Ra-226 + Ra-228).

Gamma radiation count measurements for the project were made using Ludlum Model 2221 survey meter and an unshielded 2 x 2 inch NaI probe (Model 44-10). For the instrument used, the gamma count threshold equivalent to the USEPA cleanup value of 7.1 pCi/g was 18,279 counts per minute (cpm) unshielded (6,282 cpm shielded). The field gamma background for the area was measured at approximately 5,600 cpm unshielded as measured at an area of exposed soil within the property boundary in the vicinity of the B-8 boring location.

The field gamma measurements of the spoil generated during the drilling process did not exceed the instrument threshold previously stated and ranged from a minimum of 5,500 cpm to a maximum of 6,900 cpm unshielded. Thus, based on the gamma readings there was no indication of the presence of radiologically-contaminated material or an exceedance of the USEPA cleanup value of 7.1 pCi/g total radium. A copy of the environmental boring location figure as well as a table documenting the radiological soil surveys performed at each location are included as attachments.

As part of the permit conditions this letter has been forwarded to:

Chicago Department of Public Health
Attention: Ms. Rahmat Begum
333 South State Street, Room 200
Chicago, Illinois 60604

Please contact us with any questions you have regarding this letter or the reported results.
Regards,

Brian R. Schmidt
Project Scientist II

Steven C. Kornder, Ph.D.
Senior Project Geoscientist

cc: Rahmat Begum, Chicago Department of Public Health
Verneta Simon, USEPA
M. Wells-Paske, Pioneer Environmental Services, LLC
L. Koch, Related Midwest

Attachments: Permit
Boring Location Figure
Boring Logs
Radiological Soil Survey Table

PERMIT

DEPARTMENT OF PUBLIC HEALTH
CITY OF CHICAGO

FORM NO. CDPH.PRPTY.02 (STREETERVILLE - Private Property)

Notice is hereby given that the site you have requested a permit for is recorded with the City of Chicago Department of Public Health (CDPH) as potentially having environmental contamination on the site. This environmental contamination could present a threat to human health and safety in connection with work performed at the site, if proper safeguards are not employed.

A file containing detailed information regarding the aforementioned environmental contamination is available for review at CDPH at 333 S. State St., Room 200, Chicago, Illinois 60604 during normal business hours (8:30AM-4:30PM, Monday through Friday). Contact (312) 745-3152 for an appointment. This file must be reviewed and the remainder of this form completed before the permit can be issued if the ground is exposed or excavated. **Please note that for some locations, additional health and safety procedures may be required by law.**

Please complete the following:

I have reviewed and understand the documents, maintained by CDPH, regarding environmental contamination of the site. Further, I will ensure that all work at the subject site, and any monitoring required, including but not limited to, radiation monitoring, will be performed in a manner that is protective of human health and the environment and in compliance with all applicable local, state, and federal laws, rules, and regulations, especially those pertaining to worker safety and waste management. I will ensure that the results of any radiation monitoring and/or surveying conducted shall be provided to CDPH and the United States Environmental Protection Agency (USEPA) **within two (2) weeks of their completion.** If any elevated levels of radioactive material are detected, I will immediately contact the United States Environmental Protection Agency at (800) 424-8802.

Applicant Name (print): Megan Wells-Paske on behalf of Pioneer Environmental Services Signature: Megan Wells-Paske

Site Address and Work Location (Describe exact site location and **attach map**): 451 E. Grand Ave. / 456 E. Illinois St; Private property along the West side of Peshtigo Ct., South of Grand Ave, North of Illinois St.

Nature of Work: Soil borings / monitoring wells

Company Name, Address, Phone No.: Pioneer Environmental Services, LLC 700 N. Sacramento Blvd. Suite 101 Chicago, IL 60612 (773)722-9200

General / Prime Contractor Name, Address, Phone No.: Pioneer Environmental Services (SAA)
Include subcontractor information if applicable)

Safety Officer / Phone No. Megan Wells-Paske (773) 722-9200 x 202

Radiation Contractor / Phone No. (if applicable) AECOM (Steve Korndor) / (262)515-7700

Check if City Department Work ☐ Department Name: _____

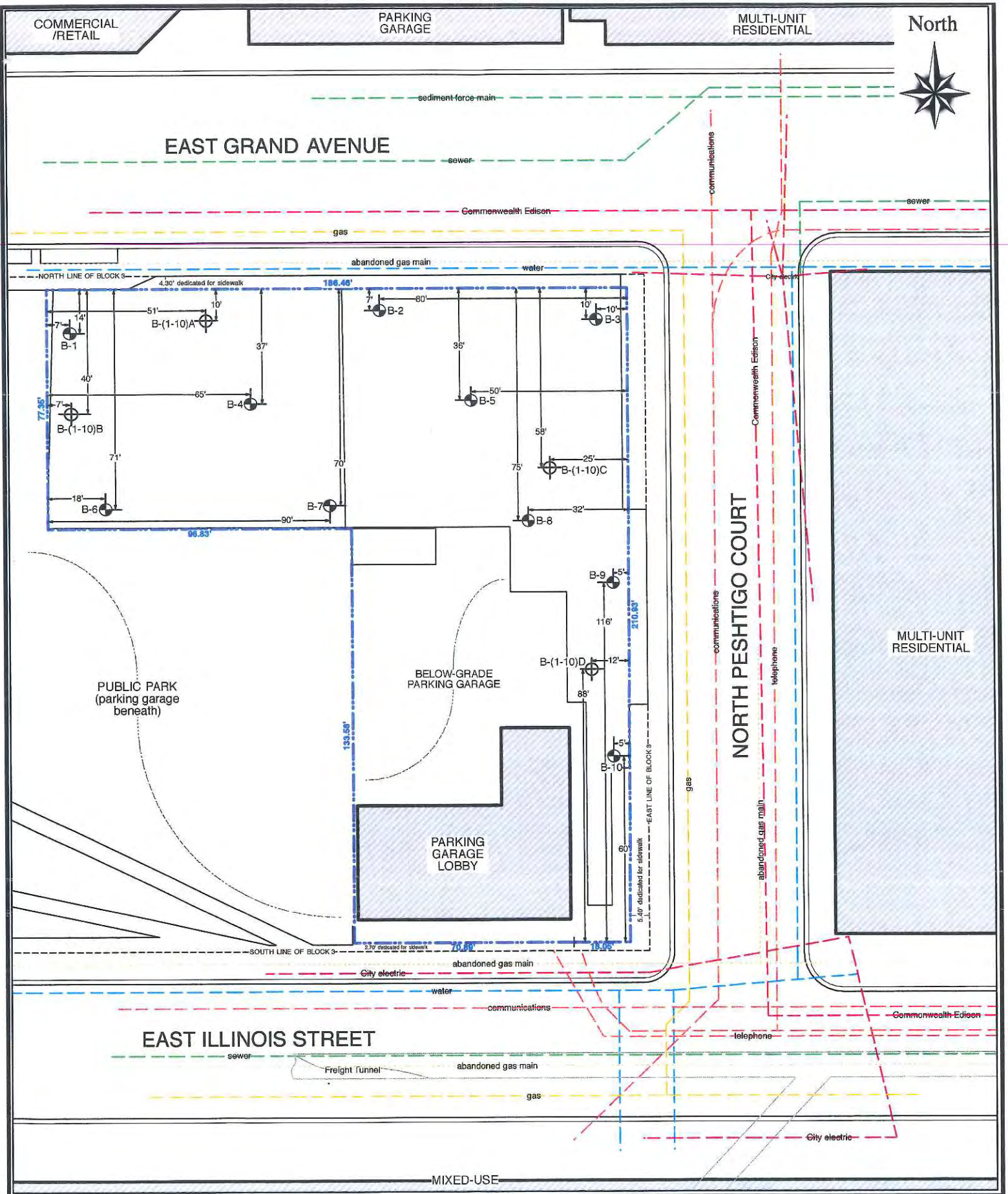
CDOT Permit No. or Developer Services No..: _____

Today's Date: 6/12/15 Expected Start Date: 7/1 & 7/2/15 CDPH Approval / Date Kahmatunisa Begu 6/17/2015

Please return this completed form along with maps showing exact site location to CDPH at 333 S. State St., Room 200, Chicago, Illinois 60604 during normal business hours (8:30 AM - 4:30 PM, Monday through Friday)

For CDPH Use Only

BORING LOCATION MAP AND LOGS



PIONEER ENVIRONMENTAL SERVICES, LLC

Legend:
- Property Line
- Proposed Soil Boring Location
- Proposed Alternate Soil Boring Location

Scale: 1" = 40' (0' — 40')	Date: April 2015
Drawn by: Kendrick Ting	Checked by: Megan Wells-Paske
Job No.: 13-0425-102	

FIGURE 1
Proposed Boring Locations
451 East Grand Avenue & 456 East Illinois Street
Chicago, IL

PIONEER ENVIRONMENTAL SERVICES, LLC

Boring Log

Boring No.: B-1

Site:
451 E. Grand Ave
Chicago, IL

Date Begin: 7/2/15

Date End: 7/2/15

PID (ppm)	Sample Recovery	Sample	Depth Feet	Soil Class	Lithology	Description	Remarks
<1	75%			Fill		FILL (concrete, gravel, black sand), loose, moist	No Odor, No Visual
<1				Fill		FILL (white crushed stone, sand), loose, moist	
<1	50%		5	Fill		FILL (gravel, bricks, sand, silt, clay), loose, moist	No Odor, No Visual
<1			10				
<1	25%			Fill		FILL (gravel, bricks. sand, silt, clay), loose, wet	No Odor, No Visual
<1			15	SM		Black / Gray Fine SAND, loose, wet	
<1	25%			SM		Gray Fine SAND, loose, wet	No Odor, No Visual
<1			20			Boring Terminated @ 20'	

Completion Notes:
Hatched Pattern Denotes Sample Analyzed

Drill Rig:	Geoprobe 6620 DT
Driller:	D. Laureano & J. Marino
Geologist:	J. Mizwicki
LUST Incident No:	

Water Depth While Drilling: 12.5' Water Depth After Drilling: NA

Project Number: 13-0425-102

PIONEER ENVIRONMENTAL SERVICES, LLC

Boring Log

Boring No.: B-2

Site:
451 E. Grand Ave
Chicago, IL

Date Begin: 7/1/15

Date End: 7/1/15

PID (ppm)	Sample Recovery	Sample	Depth Feet	Soil Class	Lithology	Description	Remarks
				Fill		8" FILL (black sand, gravel), loose, moist	
3	75%					FILL (crushed bricks, concrete, gravel, sand), loose, moist	No Odor, No Visual
7			5	Fill			
<1	<10%						No Odor, No Visual
						Boring Refusal @ 8'	
			10				
			15				
			20				

Completion Notes:
Hatched Pattern Denotes Sample Analyzed

Drill Rig:	Geoprobe 6620 DT
Driller:	D. Laureano & J. Marino
Geologist:	J. Mizwicki
LUST Incident No:	

Water Depth While Drilling: ND Water Depth After Drilling: NA

Project Number: 13-0425-102

PIONEER ENVIRONMENTAL SERVICES, LLC

Boring Log

Boring No.: B-3

Site:
451 E. Grand Ave
Chicago, IL

Date Begin: 7/1/15

Date End: 7/1/15

PID (ppm)	Sample Recovery	Sample	Depth Feet	Soil Class	Lithology	Description	Remarks
<1	50%			Fill		FILL (crushed bricks, gravel, sand), loose, moist	No Odor, No Visual
<1			5				
<1	25%						No Odor, No Visual
						Boring Refusal @ 8'	
			10				
			15				
			20				

Completion Notes:
Hatched Pattern Denotes Sample Analyzed

Drill Rig:	Geoprobe 6620 DT
Driller:	D. Laureano & J. Marino
Geologist:	J. Mizwicki
LUST Incident No:	

Water Depth While Drilling: ND Water Depth After Drilling: NA

Project Number: 13-0425-102

PIONEER ENVIRONMENTAL SERVICES, LLC

Boring Log

Boring No.: B-4

Site:
451 E. Grand Ave
Chicago, IL

Date Begin: 7/2/15

Date End: 7/2/15

PID (ppm)	Sample Recovery	Sample	Depth Feet	Soil Class	Lithology	Description	Remarks
<1	75%			Fill		FILL (concrete, gravel, black sand), loose, moist	No Odor, No Visual
<1				Fill		FILL (white crushed stone, sand), loose, moist	
			5			Boring Refusal @ 5'	
			10				
			15				
			20				

Completion Notes:
Hatched Pattern Denotes Sample Analyzed

Drill Rig:	Geoprobe 6620 DT
Driller:	D. Laureano & J. Marino
Geologist:	J. Mizwicki
LUST Incident No:	

Water Depth While Drilling: ND Water Depth After Drilling: NA

Project Number: 13-0425-102

PIONEER ENVIRONMENTAL SERVICES, LLC

Boring Log

Boring No.: B-5

Site:
451 E. Grand Ave
Chicago, IL

Date Begin: 7/1/15

Date End: 7/1/15

PID (ppm)	Sample Recovery	Sample	Depth Feet	Soil Class	Lithology	Description	Remarks
				Fill		FILL (black sand, gravel), loose, moist	
4	75%			Fill		FILL (rubble, crushed brick, sand, gravel), loose, moist	No Odor, No Visual
3			5				
<1	25%						No Odor, No Visual
						Boring Refusal @ 8'	
			10				
			15				
			20				

Completion Notes:
Hatched Pattern Denotes Sample Analyzed

Drill Rig:	Geoprobe 6620 DT
Driller:	D. Laureano & J. Marino
Geologist:	J. Mizwicki
LUST Incident No:	

Water Depth While Drilling: ND Water Depth After Drilling: NA

Project Number: 13-0425-102

PIONEER ENVIRONMENTAL SERVICES, LLC

Boring Log

Boring No.: B-6

Site:
451 E. Grand Ave
Chicago, IL

Date Begin: 7/2/15

Date End: 7/2/15

PID (ppm)	Sample Recovery	Sample	Depth Feet	Soil Class	Lithology	Description	Remarks
<1	60%			Fill		FILL (crushed gravel, concrete, bricks, sand), loose	No Odor, No Visual
<1			5	SM		Brown Fine SAND, loose	
<1	60%						No Odor, No Visual
<1			10				
--	0						
<1			15	SP		Gray Fine SAND, with gravel, loose	
	50%						No Odor, No Visual
<1			20			Boring Terminated @ 20'	

Completion Notes:
Hatched Pattern Denotes Sample Analyzed

Drill Rig:	Geoprobe 6620 DT
Driller:	D. Laureano & J. Marino
Geologist:	J. Mizwicki
LUST Incident No:	

Water Depth While Drilling: ND Water Depth After Drilling: NA

Project Number: 13-0425-102

PIONEER ENVIRONMENTAL SERVICES, LLC

Boring Log

Boring No.: B-7

Site:
451 E. Grand Ave
Chicago, IL

Date Begin: 7/2/15

Date End: 7/2/15

PID (ppm)	Sample Recovery	Sample	Depth Feet	Soil Class	Lithology	Description	Remarks
<1	50%			Fill		FILL (gravel, sand, clay)	No Odor, No Visual
<1			5	SM		Brown Fine SAND	
<1	50%			Fill		FILL (gravel, clay, brick)	No Odor, No Visual
<1				SM		Brown Fine SAND	
--	0		10			No Recovery	
						Boring Refusal @ 12.5'	
			15				
			20				

Completion Notes:
Hatched Pattern Denotes Sample Analyzed

Drill Rig:	Geoprobe 6620 DT
Driller:	D. Laureano & J. Marino
Geologist:	J. Mizwicki
LUST Incident No:	

Water Depth While Drilling: ND Water Depth After Drilling: NA

Project Number: 13-0425-102

PIONEER ENVIRONMENTAL SERVICES, LLC

Boring Log

Boring No.: B-8

Site:
451 E. Grand Ave
Chicago, IL

Date Begin: 7/1/15

Date End: 7/1/15

PID (ppm)	Sample Recovery	Sample	Depth Feet	Soil Class	Lithology	Description	Remarks
				Fill		4" FILL (gravel, black sand), loose, moist	
<1	75%		4	Fill		FILL (brown fine sand), loose, moist	No Odor, No Visual
<1							
<1	60%		8	Fill		FILL (sand, gravel, bricks), loose, wet	No Odor, No Visual
<1				Fill		FILL (sand, gravel, bricks), loose, moist	
<1	75%		12	Fill		FILL (black / brown sand/gravel; bricks and gravel), loose, wet	No Odor, No Visual
<1							
<1	75%		16	SM		Gray / Black Fine SAND, loose, wet	No Odor, No Visual
						Boring Refusal @ 18.5'	

Completion Notes:
Hatched Pattern Denotes Sample Analyzed

Drill Rig:	Geoprobe 6620 DT
Driller:	D. Laureano & J. Marino
Geologist:	J. Mizwicki
LUST Incident No:	

Water Depth While Drilling:~10' Water Depth After Drilling: NA

Project Number: 13-0425-102 Page 1

PIONEER ENVIRONMENTAL SERVICES, LLC

Boring Log

Boring No.: B-9

Site:
451 E. Grand Ave
Chicago, IL

Date Begin: 7/1/15

Date End: 7/1/15

PID (ppm)	Sample Recovery	Sample	Depth Feet	Soil Class	Lithology	Description	Remarks
				Fill		6" FILL (gravel, sand), loose, moist	
<1	60%			Fill		FILL (black / brown fine sand), loose, moist	No Odor, No Visual
<1			4				
				Fill		FILL (crushed bricks, concrete, gravel), loose, moist	
<1	50%			SM		Black / Brown Fine SAND (possibly fill), loose, moist	No Odor, No Visual
			8				
						Boring Refusal @ 9'	
			12				
			16				

Completion Notes:
Hatched Pattern Denotes Sample Analyzed

Drill Rig:	Geoprobe 6620 DT
Driller:	D. Laureano & J. Marino
Geologist:	J. Mizwicki
LUST Incident No:	

Water Depth While Drilling: ND Water Depth After Drilling: NA

Project Number: 13-0425-102

PIONEER ENVIRONMENTAL SERVICES, LLC

Boring Log

Boring No.: B-10

Site:
451 E. Grand Ave
Chicago, IL

Date Begin: 7/1/15

Date End: 7/1/15

PID (ppm)	Sample Recovery	Sample	Depth Feet	Soil Class	Lithology	Description	Remarks
				Fill		FILL (black sand and gravel, sand), loose, moist	
<1	50%			Fill		FILL (rubble, gravel, bricks, sand), loose, moist	No Odor, No Visual
<1			5				
<1	50%						No Odor, No Visual
						Boring Refusal @ 8'	
			10				
			15				
			20				

Completion Notes:
Hatched Pattern Denotes Sample Analyzed

Drill Rig:	Geoprobe 6620 DT
Driller:	D. Laureano & J. Marino
Geologist:	J. Mizwicki
LUST Incident No:	

Water Depth While Drilling: ND Water Depth After Drilling: NA

Project Number: 13-0425-102

RADIOLOGICAL SOIL SURVEY TABLE

Radiological Soil Survey of Drill Spoils
451 East Grand Ave. and 456 East Illinois St.
Chicago, IL

Boring ID	Depth (ft bgs)	Maxiumum Gamma Count (cpm)	Depth of Boring Refusal (ft-bgs)
B-1	0-5	6400	N/A
	5-10	6900	
	10-15	6200	
	15-20	5900	
B-2	0-5	6400	8
	5-8	No Recovery	
B-3	0-5	6200	8
	5-7.5	5700	
B-4	0-5	5700	5
B-5	0-5	6200	8
	5-8	5800	
B-6	0-5	5800	N/A
	5-10	5600	
	10-15	No Recovery	
	15-20	6600	
B-7	0-5	5600	12.5
	5-10	6400	
B-8	0-5	5700	18.5
	5-10	6000	
	10-15	6200	
	15-18.5	6300	
B-9	0-5	6100	9
	5-9	5500	
B-10	0-5	5800	8
	5-8	6800	

Notes:
Ludlum Model 2221 survey meter and an unshielded 2 x 2 inch Nal probe (Model 44-10). Threshold equivalent to the USEPA cleanup value 7.1 pCi/g is 18,279 counts per minute (cpm).

APPENDIX E

Standard Operating Procedures

SOP-210	Gamma Radiological Surveys
SOP-212	Air Monitoring Procedure
SOP-214	Soil Sampling Procedure
SOP-215	Field Logbook Procedure
SOP-217	Excavation Procedure
SOP-223	Verification Survey
SOP-320	Radioactive Material Shipments
SOP-343	Ludlum Model 2221
SOP-345	Survey for Surface Contamination and Release of Equipment for Unrestricted Use
SOP-347	Decontamination
SOP-364	Sample Preparation Procedure for Gamma Spectral Analysis
SOP-366	Operation of the ACCUSPEC Gamma Counter
SOP-372	Operation of the Ludlum Model 2000 Alpha System

510 NORTH PESHTIGO COURT
CHICAGO, ILLINOIS

STANDARD OPERATING PROCEDURE

Title: Gamma Radiological Surveys

Document: SOP-210

Revision Number: 1

Date: December 16, 2015 Replaces: October 5, 2015

GAMMA RADIOLOGICAL SURVEYS

1.0 PURPOSE

This procedure provides protocols for conducting gamma radiological surveys for potentially contaminated soil and/or fill material.

2.0 SCOPE

Radiological surveys will be performed at the designated Site as part of the surface screening, excavation, and verification surveying programs.

3.0 REFERENCES

- NUREG 1507 – *Minimum Detectable Concentrations With Typical Radiation Survey Instruments for Various Contaminants and Field Conditions*
- NUREG 1575, Rev. 1 - Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)

4.0 EQUIPMENT AND MATERIALS

The following equipment may be used as part of the survey programs. Other equipment may be substituted if necessary because of availability of the items listed or the conditions encountered at the site.

- Trimble Pathfinder Pro XR 4.1 global positioning system (GPS), or equivalent (optional).
- Ludlum Model 44-10 2 x 2 inch sodium iodide (Nal) (Tl) gamma detector.
- 6-inch collimated lead shield for detector.
- Ludlum Model 2221 portable scaler ratemeter analyzer.

5.0 INSTRUCTIONS FOR RADIOLOGICAL SURVEY

5.1 Establishment of Background Gamma Count Rate

5.1.1 The gamma count rate background levels shall be established for each applicable survey instrument. Six randomly selected locations of similar media (i.e., paved, landscaped, etc.) shall be chosen in non-radiologically contaminated areas of the Site. A one minute integrated count shall be obtained at the surface of each location for each survey instrument (Ludlum 2221 with 2 x 2 in NaI probe). The measurements collected from each location shall be averaged to establish an instrument specific background gamma count rate.

5.2 Land Surface Survey Procedure - Manual

5.2.1 Establish a Grid Network

5.2.1.1 Two perpendicular baselines will be established.

5.2.1.2 A grid along the baseline will be established using cloth or steel tape and a compass, if necessary. Stakes, survey flags, or paint will be placed as needed to delineate grid or traverse lines. The grids will be spaced about twenty feet apart.

5.2.1.3 The baseline, permanent structures, areas of remediation, and other areas of interest will be illustrated in the field logbook.

5.2.2 Gamma Survey Procedure – Manual Data Recording

5.2.2.1 The Ludlum ratemeter is set for 2 second time-weighted average count rate.

5.2.2.2 Hold the survey meter probe base parallel to the ground surface at a height as close as practical and not more than 3 inches from the ground surface. Note: It is important to keep the meter at a consistent height since counts will vary with the distance from the surface.

5.2.2.3 Walk along grid lines at a maximum speed of about 0.5 meters per second (1 mile per hour). Grid will be traversed with a serpentine pattern, spaced 3 feet apart.

5.2.2.4 Identify locations with count rates greater than twice the background count rate and record them or the Radiation Survey Form – Surface Gamma Scan.

5.3 Land Surface Survey Procedure – Continuous Data Logging with GPS

5.3.1 Gamma Survey Procedure

5.3.1.1 Position the survey meter probe base parallel to the ground surface at a height as close as practical and not more than 3 inches from the ground surface. Note: It is important to keep the meter at a consistent height since counts will vary with the distance from the surface.

5.3.1.2 Traverse the survey area at a maximum speed of about 0.5 meters per second (1 mile per hour). The survey area will be traversed in a serpentine pattern, spaced 3 feet apart.

5.3.1.3 Ludlum and GPS equipment will be interfaced with a computer/data logger that will collect gamma surface readings, and the associated GPS coordinates, at two second intervals.

5.3.1.4The GPS coordinates and gamma survey results will be plotted with locations exhibiting gamma count rates greater than twice background highlighted.

5.4 Radiological Survey of On-Site Materials

5.4.1 Material that is excavated and placed in the clean stockpile will be surveyed two ways. The first survey will be performed prior to excavation activities.

5.4.2 The second survey, and subsequent surveys, will be performed during the excavation of the non-contaminated fill or soil. These materials will be surveyed before they are placed in the stockpile, if the excavation can be entered safely. Based on the gamma scan, the material will either be designated as contaminated material and immediately loaded for transportation and disposal or tentatively designated as clean and stockpiled for subsequent sampling per Standard Operating Procedure (SOP)-214.

5.5. Daily Surveys

5.5.1 Routine daily surveys shall be performed for each day of operations at the site.

5.5.2 The routine surveys will monitor areas in the immediate vicinity of excavations and along movement paths to ensure that radiation levels are not affected by activities.

5.5.3 Routine surveys shall be documented by preparing a drawing of the survey results in the field logbook, indicating either the location and value of individual measurements, or contours of the measured gamma field.

5.5.4 Surveys of excavation areas will be made at the request of the Field Team Leader to assess the progress of the removal. These surveys will not be documented, but will be used by the Field Team Leader to manage the excavation.

5.6 Pre-Verification or Verification Survey

5.6.1 Upon completion of remediation excavation activities, either a pre-verification survey shall be performed to ensure that the excavation is ready for a final verification survey by regulatory authority (i.e., USEPA) or a verification survey shall be performed to ensure that the excavation is ready for backfill based on the approval of the regulatory authority.

5.6.2 The survey is conducted at the same time as the excavation work phase. The survey method is performed as specified in Sections 5.2 and/or 5.3. Upon completion of the survey and excavation phase, a Notification of Successful Pre-Verification or Verification is sent to the regulatory authority requesting a final verification survey or approval to backfill.

5.7 Site Grading Survey

5.7.1 Surveys will likely be conducted prior to or at the same time as the grading activities and will be performed as specified in Sections 5.2 and/or 5.3 of this SOP.

5.7.2 The corners or boundaries of the area to be surveyed will be tied into a site-wide coordinate/survey network. Stakes, survey flags, or paint will be placed along the boundaries of the survey area using a cloth/steel tape or wheel at approximately 20 foot intervals to subdivide the area into 20 x 20 foot areas.

5.7.3 Each 20 x 20 foot area will be traversed using a line spacing of approximately 4 foot. Readings greater than twice background will be painted and flagged for further investigation.

5.7.4 The maximum gamma count and readings over twice background will be recorded on the radiation survey form for site grading. Permanent structures and other issues of interest also will be included on the radiation survey form.

5.8 Caisson Construction Radiological Surveying

5.8.1 Procedures for Caisson Probe Test Pits. Note: These procedures will only be implemented if caissons are to be constructed at the Site.

5.8.1.1 The ground surface will be surveyed for elevated gamma radiation prior to beginning excavation. Excavation monitoring will include three survey efforts: 1) surveys of the excavation walls and floor until native sand is encountered, 2) surveys of the excavated fill while still in the excavator bucket, and 3) surveys of the excavation spoil pile.

5.8.1.2 Excavation will proceed in lifts not to exceed 18 inches per lift. The excavation walls and floor will be surveyed at each 18 inch lift until native sand is encountered. Additionally, the excavation spoil pile will be surveyed as excavation proceeds. Appropriate sloping of the test pit walls will be required to allow safe access for persons to enter the excavation for surveying the walls and floor. If the excavation is of such a dimension to preclude safe access of personnel to survey the walls and floor, the excavator bucket may be used to collect representative material from test pit and place the material in a spoil pile. Surveys of the spoil pile may be used to characterize the in-place material.

5.8.1.3 If elevated gamma radiation measurements are noted, equal to or exceeding twice the background gamma count, the excavation will proceed in thinner lifts, 6 to 12 inches. If

the excavated fill exceeds the removal action limit, the radiologically-contaminated fill will be staged on plastic separate from the uncontaminated fill or soil and the pile will be marked with radiation rope. Alternatively, the contaminated fill will be loaded directly into a Baker type box or super-sack.

5.8.1.4 Excavation equipment that has contacted radiologically-contaminated fill will be surveyed with a Ludlum Model 3 Pancake Probe for elevated radioactivity. Indications of elevated radioactivity will require decontamination in accordance with the Work Plan SOP 347, Decontamination. Equipment in contact with the radiologically-contaminated fill will be documented as clean through a swipe survey and alpha radiation count using the Ludlum Model 220 and Model 43-10 Alpha counter, in accordance with the Work Plan SOP 345, Survey for Surface Contamination and Release of Equipment for Unrestricted Use.

5.8.2 Procedures for Surveying during Caisson Installation

5.8.2.1 Areas previously screened to native soil will not be resurveyed. Auger spoils from caisson borings through unscreened fill (including fill from below the groundwater table) will be screened after the materials are removed from the borehole.

5.8.2.2 When practical, spoil on the caisson augers will be screened before being spun off. If the field screening indicates elevated gamma measurements, the auger spoil will be spun off onto an area covered with plastic to temporary contain the material for later placement in containers for offsite transport and disposal. Otherwise, the fill will be spun off and handled as appropriate for soil management.

5.8.2.3 Management of contaminated fill during caisson construction will consist of the following. Radiation-trained laborers or excavating equipment will place that fill into approved containers (Baker type boxes or super-sacks, depending on apparent volume).

5.8.2.4 Prior to moving to a new location the Health Physics Technician will release the auger and other equipment that may have come in contact with contaminated fill using SOP-345. Decontamination procedures are outlined in the Work Plan SOP 347.

5.8.3 Required Documentation

5.8.3.1 Caisson locations found to contain contaminated fill and will be recorded. The background gamma count and maximum gamma radiation reading will be noted, along with the equipment specific threshold indicative of 7.1 pCi/g total radium and the depth at which the contaminated fill material was encountered. Records will also identify any samples taken, the person(s) conducting the monitoring, the date the work was started and completed, and equipment serial numbers.

510 NORTH PESHTIGO COURT
CHICAGO, ILLINOIS

STANDARD OPERATING PROCEDURE

Title: Air Monitoring Procedure

Document: SOP-212

Revision Number: 1

Date: December 16, 2015 Replaces: October 5, 2015

AIR MONITORING PROCEDURE

1.0 INTRODUCTION

The Air Monitoring Procedure provides for measuring the concentration of radioactive airborne dust that could be generated and emitted into the atmosphere as a result of the excavation, moving, and loading activities planned at the Site. The objectives of data collection for air monitoring activities are as follows:

- Collect airborne radioactivity data for the purpose of determining the exposure of workers participating in Site activities to airborne particulates
- Collect airborne radioactivity data to measure releases of airborne radioactivity to the environment and ensure that people living and working in the surrounding areas of the Site are not exposed to radiation above acceptable limits
- Collect airborne radioactivity data to evaluate work procedures and Site control measures for the purpose of keeping exposures to both workers and the general public as low as reasonably achievable (ALARA).

2.0 REGULATORY REQUIREMENTS AND ADMINISTRATIVE LIMITS

As specified in 10 Code of Federal Regulations (CFR) Part 20 (unless more restrictive in 32 Illinois Administrative Code (IAC) 340) the licensee must demonstrate compliance with the dose limits for individual members of the public. The Site Air Monitoring Plan is based on being able to demonstrate that the average concentrations of radioactive materials in gaseous and liquid effluents at the boundary of the unrestricted area do not exceed the limits specified in Table 2 of Appendix B to 10 CFR 20. The radionuclides in the thorium and uranium series that could potentially be encountered during Site activities are listed in Table 1 of the Air Monitoring Plan. Th-232 has the most restrictive concentrations for both the Derived Air Concentration (DAC) and Air Effluent Limits.

Th-232 Class W DAC=$5x10^{-13}$ μCi/ml Air Effluent=$4x10^{-15}$ μCi/ml

Both worker exposure to airborne particulates and effluent release limits will be based on Th-232.

3.0 AIR MONITORING EQUIPMENT AND MATERIALS

- Staplex Model TFIA High Volume Air Samplers (or equivalent)
- Gilan Model BDXII Low Volume Personal Air Sampler (or equivalent)
- Staplex Model TFA810 “Ashless” Filter Papers – 95% collection efficiency of 1 micron particles. Effective efficiency of 70% (penetration absorption 30%)
- Zefon Model 739 MCE Filter Cartridges – 37 millimeter (mm) x 0.8 micrometer (μm) membrane filters
- Ludlum Model 2200 Scaler w/ Model 43-10 alpha scintillation detector
- Radiological Air Sample Data Form – Area Monitors, Form Standard Operating Procedure (SOP) 212-10
- Radiological Air Sample Data Form – Personal Air Monitors, Form SOP 212-11

4.0 SITE AIR MONITORING PROCEDURE

4.1 Background Air Quality

One downwind, high volume air sample will be collected for a minimum of forty hours (five eight-hour days) prior to the commencement of excavation activities if requested by the USEPA. This sample shall be analyzed the day after collection and then again after four days to allow for the decay of short lived radon and thoron daughters. The count, after four days decay, will serve as the official measurement of the background airborne alpha concentration. Future results during Site operations should be compared to this value to see if further engineering controls or procedural changes are warranted.

4.2 Perimeter Air Monitoring – High Volume Samplers

Four air monitoring locations shall be used during all remediation excavation activities unless approval is obtained from the USEPA to reduce this monitoring. These monitoring units will be at the property boundary or no more than 200 feet from the limits of the areas anticipated to be excavated. Samples shall be collected during all operations where potentially contaminated fill or soil are being excavated, moved, or loaded. One monitor shall be placed on each perimeter of the site (North, South, East, and West) and collect samples at a height between one and two meters (four and eight feet) above the ground. Monitors will be located so as to provide unobstructed air flow from the source to the monitors. Flow rate through air samplers shall remain between 20 and 60 cubic feet per minute. Air sample filters shall be collected and replaced daily and submitted to the laboratory for analysis. Samples analyzed from the perimeter high volume monitors shall be used to determine the amount of airborne radionuclides leaving the Site.

4.3 Personal Air Monitoring – Lapel Samplers (Low Volume)

All workers participating in Site activities that involve the excavation, movement, or loading of potentially contaminated fill or soil within a radiological exclusion zone shall wear a Personal Air Monitor (PAM) to evaluate the air quality in the worker's breathing zone. The Health and Safety Coordinator may require that additional personnel wear PAMs if there is a potential for that worker to encounter airborne particulates during Site operations. Samples shall be collected the entire time a worker is inside the exclusion zone and the cumulative time recorded. Flow rate through air samples shall remain between 2 and 4 liters per minute. Air sample filters shall be collected and replaced daily and submitted to the laboratory for analysis. Samples analyzed from the PAMs shall be used to determine potential contributions to worker's dose from airborne radionuclides.

5.0 AIR SAMPLE ANALYSIS

The Th-232 decay series contains seven alpha-emitting nuclides: Th-232, Th-228, Ra-224, Rn-220, Po-216, Bi-212 and Po-212. Of these, the first three nuclides can be assumed to be in complete equilibrium. The noble gas Rn-220 (thoron) may be ejected from the original matrix by recoil from the alpha particle decay of Ra-224. The fraction of Rn-220 that is removed via emanation is dependent on several variables, and is assumed to range from 10% to 40%. The emanating fraction is assumed to be transported away from the original matrix. If 40% of the Rn-220 escapes, the activity of the Rn-220 and its three alpha-emitting progeny nuclides will be at 60% of the Th-232 activity. These four alpha-emitting nuclides produce a total of 3.35 alpha emissions per Rn-220 decay. Since the Rn-220 activity is 60% of the Th-232 activity, these four nuclides only emit the equivalent of two alpha particles per Th-232 decay. These two alphas when combined with the three alpha particles from the nuclides in full equilibrium with the parent result in the total emission of the five alpha particles. Thus, the Th-232 contribution will be one-fifth or 20% of the total alpha activity.

For the reasons stated above, gross alpha concentrations shall be divided by a factor of five to determine the air concentration of Th-232, which is the most limiting of the applicable air effluent concentration limits ($4x10^{-15}$ microCuries per milliliter (μCi/ml)).

5.1 High Volume Sample Analysis

A 1.75 inch diameter cutout shall be obtained from each 8 x 10 inch high volume sample collected. All data pertaining to the sample shall be included on the *Radiological Air Sample Data Form – Area Monitors* worksheet. This worksheet contains the calculations required to determine total sample volume and sample concentration.

Each sample shall be analyzed the day after collection for gross alpha concentration. The minimum counting time is 30 minutes for Th-Alpha. The "day after" count will serve as a comparison to identify high gross counts from the previous day. It is expected that naturally occurring radon and thorium daughters

will interfere with analysis, so the sample must be reanalyzed in four days. Thoron (Rn-220), if present in significant amounts, will require up to four days to allow for the decay of its Pb-212 daughter (10.6 hour half life). The count, after four days decay, will serve to be the official measurement of Th-Alpha.

Th-232 is the most restrictive of the applicable radionuclides that may be present during Site operations. The Th-232 contribution will account for 20% of the total alpha activity, so each gross alpha count must be divided by five to determine Th-232 concentration.

Multiple concentration measurements improve both precision and detection capability. Although air samples shall be counted the following day (and again four days later), effluent releases shall be reported on a weekly basis using the following calculation:

Equation A.9 NUREG 1400

$$C_{avg} = \frac{\Sigma\, T_{s,I}\, C_i}{\Sigma\, T_s}$$

where C = effluent concentration in μCi/ml
T_s = duration of sample collection

Sample concentration shall be determined using the following calculation:

Equation 6.9 *NUREG 1400*

$$C = \frac{R_n}{EFKT_S Cf} \quad (5)$$

Where: $R_n = R_g - R_b = T_g/N_g - T_b/N_b$
E = fractional filter efficiency
F = air flow rate through the air sampler, cm^3/min
Cubic feet per hour x 28.316 liters/cfh x 1000 ml/ liter
K = Counting efficiency in cpm/ μCi
T_s = duration of sample collection
Cf = collection vs. analyzed ratio: conversion factor = 0.035

** note: Cf is not part of original NUREG calculation. It has been added to account for the fact that we are only analyzing 3.5% of total filter (i.e., a 1.75 inch circle from an 8 X 10 inch filter minus the 0.3 inch border covered by the filter holding plate).

5 = Samples are analyzed for gross alpha activity. Gross alpha concentration is to be divided by five to determine Th-232 concentration

5.2 Personal Air Monitor Sample Analysis

Personal Air Monitor (PAM) samples shall be analyzed in the same manner as the high volume perimeters samples. The only exceptions are that samples may be collected over the course of one week and that calculations are performed on a different worksheet – *Radiological Air Sample Data Form – PAM's, Form SOP 212-11*.

The action level for airborne radioactivity shall be 30% of the Derived Air Concentration (DAC) for Th-232 ($DAC=5x10^{-13}$ μCi/ml). When PAM analysis indicates that concentrations have reached 1.5×10^{-13} μCi/ml, Level C protection may be considered. It is not anticipated that airborne concentrations will reach this level. Engineering controls, such as wetting of fill or soil, and procedural changes shall be implemented to keep airborne concentrations ALARA.

At the conclusion of the project, data obtained from PAM's shall be used to determine a dose from airborne radionuclides for each monitored worker.

6.0 INVESTIGATIONS AND CORRECTIVE ACTIONS

The Health and Safety Coordinator will perform investigations and responses consisting of one or more of the following actions in the event that Action Levels are exceeded:

- Verification of laboratory data and calculations.
- Analyze and review probable causes.
- Evaluate need for reanalysis or additional analysis on original sample.
- Evaluate need for resampling.
- Evaluate need for sampling of other pathways.
- Evaluate need for notifications to regulators
- Dose assessments/bioassays.

7.0 ATTACHMENTS

- Table 1 *Derived Air Concentrations (DACs) and Effluent Air Concentrations of Selected Radionuclides in the Uranium and Thorium Series*
- Minimum Detectable Concentration Calculation – Area Monitors
- Minimum Detectable Concentration Calculation – PAM's
- Radiological Air Sample Data Form – Area Monitors, Form SOP 212-10
- Radiological Air Sample Data Form – PAM's, Form SOP 212-11

TABLE 1

Derived Air Concentrations (DACs) and Effluent Air Concentrations of Selected Radionuclides in the Uranium and Thorium Series

Radionuclide	Class	10 CFR 20	
		DAC (μCi/ml)	Air Effluent (μCi/ml)
^{238}U	D w Y	$6x10^{-10}$ $3x10^{-10}$ $2x10^{-11}$	$30x10^{-12}$ $1x10^{-12}$ $6x10^{-14}$
^{234}Th	w Y	$8x10^{-8}$ $6x10^{-8}$	$3x10^{-10}$ $2x10^{-10}$
^{234}U	D w Y	$5x10^{-10}$ $3x10^{-10}$ $2x10^{-11}$	$3x10^{-12}$ $1x10^{-12}$ $5x10^{-14}$
^{230}Th	w Y	$3x10^{-12}$ $6x10^{-12}$	$2x10^{-14}$ $3x10^{-14}$
^{226}Ra	w	3x10-10	$9x10^{-13}$
^{222}Rn	With Daughters Removed With Daughters Present	$4x10^{-6}$ $3x10^{-8}$ or 0.33 of working level	$1x10^{-8}$ $1x10^{-10}$
^{214}Pb	D	$3x10^{-7}$	$1x10^{-9}$
^{214}Bi	D w	$3x10^{-7}$ $4x10^{-7}$	$1x10^{-9}$ $1x10^{-9}$
^{210}Pb	D	$1x10^{-10}$	---
^{232}Th	w Y	$5x10^{-13}$ $1x10^{-12}$	$4x10^{-15}$ $6x10^{-15}$
^{228}Ra	w	$5x10^{-10}$	$2x10^{-12}$
^{228}Th	w Y	$4x10^{-12}$ $7x10^{-12}$	$3x10^{-14}$ $2x10^{-14}$
^{220}Rn	With Daughters Removed With Daughters Present	$7x10^{-6}$ $9x10^{-9}$ or 1.0 working level	$2x10^{-8}$ $3x10^{-11}$
^{212}Pb	D	$2x10^{-8}$	$5x10^{-11}$
^{212}Bi	D w	$1x10^{-7}$ $1x10^{-7}$	$3x10^{-10}$ $4x10^{-10}$
^{228}Ac	D w Y	$4x10^{-9}$ $2x10^{-8}$ $2x10^{-8}$	$2x10^{-11}$ $8x10^{-11}$ $6x10^{-11}$
^{234m}Pa	w Y	$3x10^{-6}$ $3x10^{-6}$	$1X10^{-8}$ $9x10^{-9}$
^{235}U	D w Y	$6x10^{-10}$ $3x10^{-10}$ $2x10^{-11}$	$3x10^{-12}$ $1x10^{-12}$ $6x10^{-14}$
^{231}Pa	w Y	$6x10^{-13}$ $2x10^{-12}$	$6x10^{-15}$ $8x10^{-15}$
^{227}Ac	D w Y	$2x10^{-13}$ $7x10^{-13}$ $2x10^{-12}$	$1x10^{-15}$ $4x10^{-15}$ $6x10^{-15}$
^{227}Th	Y w	$1x10^{-10}$ $1x10^{-10}$	$5x10^{-13}$ $5x10^{-13}$

FORM SOP 212-10

RADIOLOGICAL AIR SAMPLE DATA FORM – AREA MONITORS

Equation:

Volume (V) = (Pump ml/min.) (Total Sample Time) (count/sample conversion)
Multiply Cubic Feet by 28.316 to Obtain Liters
Ml/min = (L/min.) (1000 ml/L)

SAMPLE COLLECTION

Sample #	Per. By	Date	Sample Start Time	Sample End Time	Total Sample Time	Cubic Ft/min. (CFM)	Count vs. Sampled Conv.	Total Sample Volume (ml)

Equation: Actual Activity = Activity (A) - Background (B)

Activity (A) = $\frac{\text{(Net CPM) (1/Eff.)}}{\text{(V) (2.2 E + 6 dpm/uCi) (filter retention factor) (5)}}$

Sample #	Cal. By	Date	Gross Counts	Net CPM	Detector Efficiency (EFF)	Sample Volume Analyzed (ml)	Sample Concentration (A)μCi/ml	Background Activity (B)μCi/ml	Actual Concentration μCi/ml
4-day recount									

Filter retention factor/absorption correction = 0.7 for Staplex 8x10 ashless paper filter
= 1.0 for 37mm PAM membrane filters

Note: Activity is divided 5 due to the Thorium daughters that are counted with an open window (gross alpha)

Conversion factor for volume analyzed vs. volume sampled for 1.75" diameter cut-out = 0.035

30 minute background count for _____ is _____ cpm
date

30 minute background count for _____ is _____ cpm
date

FORM SOP-212-11

RADIOLOGICAL AIR SAMPLE DATA FORM – PAM'S

Equation:

Volume (V) = (Pump liters/min.) (Total Sample Time in minutes) (1000 ml/liter)

Sample Collection

Person Wearing Monitor	Pump #	Sample #	Date	Sample Start Time	Sample End Time	Total Sample Time	Cubic liters/min. LPM	Total Sample Volume (ml)

Equation: Actual Activity = Activity (A) - Background (B)

Activity (A) = $\frac{\text{(Net CPM) (1/Eff.)}}{\text{(V) (2.2 E + 6 dpm/uCi) (filter retention factor) (5)}}$

Sample Analysis

Sample #	Cal. By	Date	Gross Counts	Net CPM	Detector Efficiency (EFF)	Sample Volume Analyzed (ml)	Sample Concentration (A)μCi/ml	Background Activity (B)μCi/ml	Actual Concentration μCi/ml

Filter retention factor/absorption correction = 0.7 for Staplex 8x10 ashless paper filter
= 1.0 for 37mm PAM membrane filters

Note: Activity is divided 5 due to the Thorium daughters that are counted with an open window (gross alpha)

30 minute background count for _____ is _____ cpm
date

30 minute background count for _____ is _____ cpm
date

MINIMUM DETECTABLE CONCENTRATION CALCULATION – PAMS

Sensidyne Personal Air Monitor Samples analyzed on Ludlum 43-10 Alpha Counter

$$MDC = \frac{2.71}{n\ E\ F\ K\ T_g\ T_g} \qquad \frac{3.29\ \sqrt{Rb}\left[\frac{1}{Tb}+\frac{1}{Tb}\right]}{n^{1/2}\ E\ F\ K\ T_s}$$

n = number of sampling intervals
E = fractional filter efficiency
F = airlow rate through the sampler in cm^3/min
K = counting efficiency in cpm/μCi
T_s = duration of sample collection in min
T_g = gross counting time
T_b = background counting time
R_n = net count rate in cpm
R_b = background count rate in cpm
C = concentration of radioactive material in the air in μCi/cm^3

N = 5 days of sampling minimum per week
E = 1.0 37mm 0.8 μm MCE Filters
F = 2.5 x 10^3 cm^3/min (or ml/min)
2.5 liters per minute x 1000 ml/l = 2500 ml/min
K = 699300
0.315 count/disintegration x 2.22 x 106 dis/μCi = 699300 cpm/μCi
T_s = 480 min
Based on a minimum of 8 hours per day
T_g = 30 min
T_b = 600 min

Rb = 0.58 cpm, based on 3000 min background count on 9/16 – 9/20/02

$$MDC = \frac{2.71}{(5)\ (1.0)\ (2500)\ (699300)\ (480)\ (30)} + 3.29\ \frac{\sqrt{(0.58)}\left[\frac{1}{(600)}+\right]\frac{1}{(30)}}{(2.24)\ (1.0)\ (2500)\ (699300)\ (480)\ (30)}$$

= 2.98 x 10^{-14} μCi/ml (gross alpha weekly MDC)
= 5.96 x 10^{-15} μCi/ml (gross alpha ÷ 5, for Th-232)

MINIMUM DETECTABLE CONCENTRATION CALCULATION

Sensidyne TFIA High Volume Air Samples analyzed on Ludlum 43-10 Alpha Counter

$$MDC = \frac{2.71}{n\ E\ F\ K\ T_g\ T_g} + \frac{3.29\ \sqrt{Rb}\left[\frac{1}{Tb}+\frac{1}{Tb}\right]}{n^{1/2}\ E\ F\ K\ T_s\ cf}$$

NUREG 1400 Air Sampling in the Workplace Appendix A (eq A.17)

n = number of sampling intervals
E = fractional filter efficiency
F = airlow rate through the sampler in cm^3/min
K = counting efficiency in cpm/μCi
T_s = duration of sample collection in min
T_g = gross counting time
T_b = background counting time
R_n = net count rate in cpm
R_b = background count rate in cpm
Cf = count vs. sample conversion
(this is not part of NUREG 1400, however, analysis volume must be taken into account)

n = 5 days of sampling minimum per week
E = 0.7 (referred to as filter retention factor on air sampling form)
F = 1.13×10^6 cm^3/min (or ml/min)
40 ft^3/min x 28.316 liters/ft^3 x 1000 ml/l = 1.13×10^6 ml/min
K = 699300
0.315 count/disintegration x 2.22 x 106 dis/μCi = 699300 cpm/μCi
T_s = 480 min
Based on a minimum of 8 hours per day
T_g = 30 min
T_b = 600 min
Cf = 0.035
8" x 10" original filter size = 80 $inches^2$
0.3 inch border is covered by sampler plate and not sampled = 10.8 $inches^2$
filter cutout = $\pi r^2 = (0.875")^2\ (3.14) = 2.41$ $inches^2$
actual sample area = 80 $inches^2$ – 10.8 $inches^2$ = 69.2 $inches^2$
sample analyzed vs. sample collected ration = 2.41/69.2 = 0.035
r_b = 0.58 cpm, based on 3000 min background count on 9/16 – 9/20/02

$$MDC = \frac{2.71}{(5)\ (0.7)\ (1.13E6)\ (699300)\ (0.035)\ (480)\ (30)} + \frac{3.29\ \sqrt{(0.58)}\left[\frac{1}{(600)}+\right]\frac{1}{(30)}}{(2.24)\ (0.7)\ (1.13E6)\ (699300)\ (0.035)(480)\ (30)}$$

= 2.69×10^{-15} μCi/ml (gross alpha weekly MDC)
= 5.39×10^{-16} μCi/ml (gross alpha ÷ 5, for Th-232)

510 NORTH PESHTIGO COURT
CHICAGO, ILLINOIS

STANDARD OPERATING PROCEDURE

Title: Soil Sampling Procedure

Document: SOP-214

Revision Number: 1

Date: December 16, 2015 Replaces: October 5, 2015

SOIL SAMPLING PROCEDURE

1.0 PURPOSE

The purpose of this procedure is to present protocol for collecting soil of fill samples for the Site.

2.0 SCOPE

This procedure applies to samples collected for radiological or geotechnical analysis. Samples may be collected of potential backfill or other soil or fill materials. The Field Team Leader will coordinate the sampling efforts.

3.0 REFERENCES

U.S. Nuclear Regulatory Commission (NRC), NUREG/CR-5849, Manual for Conducting Radiological Surveys in Support of License Termination, June 1992.

4.0 EQUIPMENT AND MATERIALS

4.1 Equipment and Materials Management

Downhole tools and samplers are cleaned in accordance with the Decontamination Procedure (SOP-347).

Cuttings, fluids, samples, and water are placed in 55 gallon drums, labeled, properly stored on-site, and disposed of in a manner that does not violate local, state or federal rules or regulations and in a manner that does not damage public or private property.

4.2 Sampling Equipment and Materials

Equipment used for soil or fill sampling includes the following:

- Auger or other Coring Tool
- Shovel and Trowel
- Plastic Collection Bags
- Plastic Sheets (optional)
- Sampling Tracking Form (Form Standard Operating Procedure (SOP)-214-1)
- Field Logbook (SOP-215)
- Field Sample Screening Form (Form SOP-214-2 or holding samples)
- Pin Flags (for marking sample locations)
- Container (for collecting potentially contaminated waste generated during the sampling process) (e.g., gloves, plastic sheets, etc.)
- Bucket (filled with clean rinse water)
- Bucket (for homogenizing samples)
- Stainless Steel Brush
- Moist Towelettes
- Paper Towels
- Latex Gloves
- Survey Instrument (for verifying clean sampling equipment and hands).

Other equipment may be substituted, if necessary, because of availability of the items listed or the conditions encountered at the site. Substitute equipment shall be documented in the Field Logbook and approved by the Field Team Leader.

5.0 SAMPLING PLAN

Selection of the sampling plan to characterize a fill or soil is a function of the goals of the investigation, the variability of the parameters being measured, and the impact of the variability on the conclusions. Samples may be collected randomly or they may be collected from specific areas deliberately chosen to represent the range of conditions expected or unusual conditions of particular interest. In general, randomly chosen samples are appropriate to assess overall site conditions. However, there may be instances where the significance of an observed condition is of interest. The choice of method will, therefore, depend on the specific goals of the sampling activity.

The procedure presents sampling methods based on random sampling. For the reasons stated above, variations to the methods provided in this procedure may be requested by the Field Team Leader. Such variations shall be documented in the Field Logbook by field personnel.

6.0 ON-SITE STOCKPILE FILL OR SOIL SAMPLING

The following are the steps to be followed for on-site stockpile fill or soil sampling.

6.1. Excavated fill or soil may be stockpiled. Samples from the stockpiles may be analyzed.

6.2. The fill or soil may be stockpiled in piles varying from a few to several thousand cubic yards. Because of this potential variation in pile size, no single method for sampling or type of equipment can be prescribed that will work for every situation. The two basic methods that can be used for sampling stockpiles, core sampling method and lift sampling method, are described in paragraphs 7.3 and 7.4, respectively. Both methods are based on the premise that in order for a sample to be representative of the pile, every particle in the pile must have an equal probability of being included in the sample.

6.3 One of the methods, the core sampling method, assumes that the pile can be completely penetrated using a coring tool (i.e., sampling probe or drill rig). On conical shaped piles, the sample is to be taken approximately perpendicular to the surface of the pile, midway between the peak and the base, to the center of the pile. On piles with flattened tops, the sample is to be taken perpendicular to the surface from the top to the bottom of the pile.

6.4 The other stockpile sampling method, the lift sampling method, assumes that the pile can not be completely penetrated with a sampling tool, and therefore must be sampled either as the fill or soil is placed in lifts onto the pile or before the fill or soil is removed in lifts for use. The samples will, therefore, only be representative of the discrete layer of fill or soil that is exposed to the sampling.

6.5. With either sampling method, to identify the areas to be sampled, the pile shall always be faced looking north. For flat topped piles, divide the stockpile into an imaginary grid with square or rectangular shaped sections approximately equal in area; the grids on flat topped piles should be numbered from left to right, top to bottom. For conical shaped piles, divide the stockpile into an imaginary grid with pie shaped sections of equal areas; the grids on conical shaped piles should be numbered in clockwise pattern.

6.6. Determine the initial number of grids and samples as follows:

Pile Size (cubic yards)	Number of Grids	Number of Lift Samples[1]	Number of Core Samples[2]
< 50	3	3	3
50 to 100	5	5	5
101 to 500 .	6	5	6
500 to 1,000	7	5	7

Pile Size (cubic yards)	Number of Grids	Number of Lift Samples[1]	Number of Core Samples[2]
1,000 to 2,000	8	6	8
2,000 to 4,000	9	6	9
4,000 to 6,000	10	7	10
6,000 to 8,000	11	7	11
8,000 to 10,000	13	8	13
10,000 to 20,000	16	8	16
20,000 to 40,000	20	10	20
40,000 to 70,000	30	15	30
70,000 to 100,000	36	15	36
100,000 to ---[3]	36+	15+	36+

Notes:

1 Take one sample from each grid randomly chosen. In order to choose the grids to be sampled randomly, use some blank sample identification tags and number the tags from one (1) to (n), where (n) represents the number of grids in each pile. Put the tags into a sample bag, shake the bag and reach in and blindly select a tag. Continue selecting tags until the required number of grids are selected. The numbers will be chosen without replacement, that is, without returning the used number to the bag. The samples shall be taken from the grids that correspond to the randomly chosen numbers. An alternative method would be to use a computer generated random numbering system available in various spreadsheet programs (i.e., Excel).

2 From the randomly chosen grids, take one composite sample for approximately every ten (10) feet of fill or soil depth to obtain the required number of samples. For example: if a 98 cubic yard pile is 10 feet high, according to the above table, five (5) composite samples are required (i.e., one for each grid). If an 11,000 cubic yard pile is 30 feet deep, three composite samples, one composite sample at each ten feet of depth, will be taken from 5 of the grids and one composite sample will be taken from a sixth, randomly chosen grid.

3 Add one sample for each additional 10,000 cubic yards.

6.7. Take the sample and submit it to the laboratory for analysis.

6.8. Statistically test the results of the sample analyses to determine how much uniformity the samples show and whether more samples must be taken.

6.9. If necessary, take additional samples and analyze. Continue to repeat steps 6.7 arid 6.8 until there are enough samples to characterize the pile.

6.10. As directed by the Field Team Leader, identify materials suitable for backfill or other purpose for which the sampling was done.

6.11. To compare the sample data with the desired criteria, calculate the average (X bar of all the samples) in the pile using:

$$\bar{x} = \frac{1}{n}\sum_{i=1}^{n} xi$$

6.12 If the average satisfies the desired criteria, the results can be further evaluated to determine whether the data provide a 95 percent confidence level that the true mean (μ) meets the relevant criteria. The Field Team Leader will consult with the Project Coordinator to determine if this further evaluation is required.

7.0 IN-SITU FILL OR SOIL SAMPLING

This section describes the methods for choosing sample locations and sampling methods.

7.1 Sample Location Selection

Appropriate in-situ fill or soil sample locations are determined by the size and uniformity of the deposit being sampled. The sampling pattern depends upon the size of the area, the uniformity of the soil stratum being sampled, and the volume of soil that is being sampled.

Sampling plans for particular purposes may specify a pre-established sampling frequency in terms of the maximum volume of soil represented by a sample. If the soil being sampled is statistically homogeneous, then the locations for samples can be selected randomly over the area and thickness of the deposit. If the soil is not statistically homogeneous, then the area must be broken into sub-areas within which the fill or soil are statistically homogeneous, and each area sampled separately. The issue of statistical homogeneity is resolved by comparing the range of variation of the property being judged to the acceptability criteria. For example, a deposit of sand and gravel may be statistically homogeneous when judged against a standard that the material not contain boulders and not be homogeneous when judged against a standard that no gravels be larger than one inch.

Clearly, also, the number of samples required to resolve the second comparison may be larger than the number required to resolve the first. The sampling frequencies given in the Sections 10.3 and 10.4 (Stockpile Sampling) may be used as a guide in estimating an initial number of samples, but the actual number required for a particular purpose depends very strongly upon the requirements and materials being sampled.

7.2 Drilling Procedures

No drilling is planned.

8.0 OPERATIONAL SUPPORT SAMPLING

Sampling may be required to support the excavation and restoration action. This sampling may be performed in instances when the Field Team Leader is interested in the significance of an observed variation or when looking for cursory information to provide operational guidance. The choice of the method will, therefore, depend on the specific goals of the sampling activity as determined by the Field Team Leader. This sampling is not a quality activity, and may be performed outside the requirements of this procedure. However, all deviations requested by the Field Team Leader must be documented in the Field Logbook by field personnel.

The sampling technique for surface sampling, subsurface sampling, and stockpile sampling, as described in this procedure, shall be used when sampling in these instances.

9.0 SAMPLE TRACKING

To establish the documentation necessary to track the sample from the time of collection, the sample identification and Sample Tracking Forms must accompany samples that are sent to the laboratory.

All potentially contaminated samples to be submitted to the laboratory will be screened for radiation in the field. Information obtained from this survey will be documented on the Sample Tracking Form (Form SOP 214-1). Samples taken from potential borrow areas generally are not screened.

10.0 SAMPLING METHODS

10.1 Surface Fill or soil Sampling

10.1.1. If necessary, to minimize contamination, spread a clean sheet of plastic next to the area to be sampled, and assemble the sampling equipment required.

10.1.2. Enter the complete information on the Sample Tracking Form:

- Sample Number
- Sample Matrix
- Sample Location
- Purpose of Sample Collection
- Include applicable comments regarding the sample, location, weather, conditions, or other factors that may be relevant
- Collected by (your name)

10.1.3. Mark the collection bag or prepare the identification tag for the sample.

10.1.4 Collect the fill or soil samples that are representative of the fill or soil in the area surveyed. Use a shovel or trowel to collect fill or soil from the depth required.

10.1.5 Remove rocks, sticks, and foreign objects greater than approximately one-quarter (1/4) inch.

Stir and homogenize the fill or soil in a bucket as much as practicable. Using the hand trowel, randomly scoop the fill or soil from the bucket. Saving each of the scoops of material to collect the required sample size, return the other material to the sampling locations.

10.1.6 Attach the identification tag to the sample bag if appropriate, and place the bag in the sample container.

10.1.7 Decontaminate the sampling equipment as required by Section 11.

10.1.8 Return any location markers (such as pin flags) that were removed in order to sample. Fill in all sampling holes to eliminate a possible tripping hazard.

10.1.9 If specific data is not available, mark a pin flag with the sample identification number, and place the flag at the center of the sampling location before leaving.

10.2 Subsurface Sampling (Undisturbed Materials)

10.2.1 If necessary, to minimize contamination, spread a clean sheet of plastic next to the area to be sampled, and assemble the sampling equipment required.

10.2.2 Enter the complete information on the Sample Tracking Form

- Sample Number
- Sample Matrix
- Sample Location
- Purpose of Sample Collection
- Include applicable comments regarding the sample, location, weather, conditions, or other factors that may be relevant
- Collected by (your name)

10.2.3 Mark the collection bag or prepare the identification tag for the sample.

10.2.4 Sample the material using a hand core sampling tool or hammer driven split spoon sampler.

Alternatively, an auger method may be used.

Cut a hole, approximately six (6) inches in diameter, in the center of a plastic sheet. Center the sheet of plastic over the area to be sampled. Using an auger, drill through the hole in the plastic to the desired sampling depth; keep the auger turning until no more material comes up. The fill or soil around the hole, on the plastic sheet, is fairly well mixed and representative of the interval just drilled.

If the fill or soil sample is to be obtained from a particular depth (not a composite from surface to depth), and the material refuses to pass into the coring tool, the following sampling method will be performed. Drill through the hole in the plastic to the top of the desired sampling depth; keep the auger turning until no more material comes up. Remove the auger and sample the material using a hand core sampling tool or hammer driven spilt spoon sampler. The few inches of the sample obtained may constitute sidewall slough and should not be part of the desired sample. The sample(s) should be collected over six-inch intervals starting below the slough material.

NOTE: If, due to the conditions of the sampling area, this method does not work, an alternative method(s), approved by the Field Team Leader, may be used. Alternative methods, when used, will be documented by the field personnel in the Field Logbook.

10.2.5 Remove rocks, sticks, and foreign objects greater than approximately one-quarter (1/4) inch in diameter.

NOTE: The removed rocks will be collected and submitted as a separate sample.

10.2.6 Using a hand trowel, collect approximately one (1) quart of the augured fill or soil in the plastic sample bag or jar. For core segments, place each 6-9 inch (nominally 5-7 inch) segment in the plastic sample bag or jar.

10.2.7 Label the sample container.

10.2.8 Return unused material to the sampling hole and fill in the hole to eliminate possible tripping hazard.

10.2.9 Decontaminate the sampling equipment as required by Section 11.

10.2.10 When required, mark a pin flag with the sample identification number and place the flag at the center of the sampling location before leaving.

10.3 Stockpile Sampling (Core Sampling Method)

10.3.1 If necessary, to minimize contamination, spread a clean sheet of plastic next to the area to be sampled and assemble the sampling equipment required.

10.3.2 Enter the complete information on the Sample Tracking Form:

- Sample Number
- Sample Matrix
- Sample Location
- Purpose of Sample Collection
- Include applicable comments regarding the sample, location, weather, conditions, or other factors that may be relevant. Identify the approximate size of the stockpile. (A 70 cubic yard pile of fill or soil is approximately ten feet high with a base diameter of

approximately 26 feet.) Include a brief description of the equipment used to obtain the sample (i.e., sub-soil sampler, drill rig, etc.).
- Collected by (your name)

10.3.3 Before sampling, determine the number of grids and samples as described in Section 6.6. Record the information in the Field Logbook.

10.3.4 Mark the collection bag or prepare the identification tags for the samples.

10.3.5 Using an auger or other coring tool, take the required number of samples from the pile. A hollow stem auger will be used when discrete, rather than composite, samples are collected.

10.3.6 Place the sample material in the sample bag and attach the identification tags. Place the sample bag in the container.

10.3.7 Decontaminate the sampling equipment as required by Section 11.

10.4 Stockpile Sampling (Lift Sampling Method)

10.4.1 If necessary, to minimize contamination, spread a clean sheet of plastic next to the area to be sampled and assemble the sampling equipment required.

10.4.2 Enter the complete information on the Sample Tracking Form:

- Sample Number
- Sample Matrix
- Sample Location
- Purpose of Sample Collection
- Include applicable comments regarding the sample, location, weather, conditions, or other factors that may be relevant. Identify the approximate size of the stockpile. (A 70 cubic yard pile of fill or soil is approximately ten feet high with a base diameter of approximately 26 feet.) Include a brief description of the equipment used to obtain the sample (i.e., sub-soil sampler, drill rig, etc.).
- Collected by (your name)

10.4.3 Before sampling, determine the number of grids and samples as described in Section 6.6. Record the information in the Field Logbook.

10.4.4 Mark the collection bag or prepare the identification tags for the samples.

10.4.5 Using the appropriate sampling tool, take the required number of samples from the lift approximately perpendicular to the surface of the lift at the appropriate locations. Composite the sample through the entire lift thickness.

10.4.6 Place the sample material in the sample bag and attach the identification tags. Place the sample bag in the container.

10.4.7 Decontaminate the sampling equipment as required by Section 11.

10.5 Sample Size

10.5.1 Samples collected for NUTRANL analysis used for EPA confirmation shall consist of a batch of five 20 milliliter bottles of fill or soil. If split samples are to be obtained, approximately 1.5 liters shall be collected. Sample size requirements are detailed in Sample Preparation Procedure for Gamma Spectral Analysis (SOP-364).

11.0 EQUIPMENT CLEANING

To avoid cross-contamination, the sampling equipment will be cleaned prior to and between samples. The following steps will be followed to clean equipment.

- Remove loose contamination by gently tapping/shaking the item.
- Using the stainless steel brush or paper towels, remove material that did not dislodge.
- If the item appears to be clean (i.e., no visible clinging fill or soil), proceed to the next sampling area.
- If the item does not appear to be clean or if a survey with the appropriate instrument does not verify that it is, scrub the item with water. While holding the item over the sampling location, rinse the item with water.
- Dry the item with paper towels or repeat the scrubbing sequence as necessary.
- Rinse gloved hands. Change gloves when changing sampling areas if a self-frisking indicates that contamination is present after rinsing.
- Approximately one percent of the time, swipe the item as described in the Gamma Radiological Survey SOP (SOP-210). Submit the swipes to the laboratory for analysis to confirm the effectiveness of the decontamination protocol. (This step is necessary only when sampling fill or soil where radiologic contamination is suspected.)
- Dispose of cleaning materials, plastic sheeting, and gloves as contaminated materials in accordance with instructions provided by the Field Team Leader.

12.0 QUALITY CONTROL

12.1 Quality Control Samples

To evaluate the variance in the fill or soil sampling protocol, field duplicates will be collected at specified intervals. These quality control (QC) samples will be identified and noted in the Field Logbook.

To validate the sampling protocol used for surface sampling, initially one (1) area on every twenty (20) sub-grids sampled.

For surface sampling, the duplicates shall be randomly selected and identified before sampling activities begin. The duplicate sample material will be collected using the next scoop full of material each time the initial sample is saved.

For subsurface samples, one duplicate subsurface sample will be taken for every twenty (20) samples.

For subsurface sampling, the duplicate will be collected from the representative augered material.

For stockpiles, one duplicate will be taken for every twenty (20) stockpile samples, or one each day that stockpile sampling takes place, whichever is greater.

The stockpile duplicate will be taken from the node of two grids. The duplicates will be randomly selected and identified before the sampling begins.

The Field Team Leader will calculate the mean and the standard deviation for the samples analyzed. If the duplicate sample results are within three (3) standard deviations of the sample population, the sampling protocols can be considered acceptable.

If the Project Coordinator approves, the Field Team Leader can reduce the frequency of the QC duplicate sampling based on the results obtained. Changes shall be documented in the Field Logbook.

12.2 Data Review

Entries in the Field Logbook will conform to the Field Logbook Standard Operating Procedures.

Daily, the Field Team Leader will review the Field Logbook, resolve any discrepancies that were noted by field personnel, and sign the book to indicate the pages reviewed. If the Field Team Leader recorded the discrepancy, the Quality Assurance Supervisor will review the Field Logbook and resolve any discrepancies that were noted.

NOTE: Discrepancies relating to reported data will be brought to the attention of the Field Team Leader.

13.0 HEALTH AND SAFETY

Personal protective equipment and clothing, as required by the Health and Safety Plan, will be used when collecting and handling contaminated fill or soil.

The site radiological conditions will be determined and documented before sampling begins. During the sampling process, the principles of As Low As Reasonably Achievable (ALARA) will be followed.

14.0 RECORDS

The following documents will be maintained as quality records:

- Field Logbooks
- Sampling Tracking Forms
- Results of all Calculations and Statistical Analyses Performed

FORM SOP-214-1

SAMPLE TRACKING FORM

Date: _____ Page _____ of _____

Sample Number	Matrix (S/W)	Location	Collected For	Comments	Collected By
Released by/company			All samples listed above are hereby released except for:		Date/Time
Received by/Company			All samples listed are hereby received except for:		Date/Time
Received by/Company			Data for all samples listed above are hereby received except for:		Date/Time

FORM SOP-214-2

FIELD SAMPLE SCREENING FORM

Sample Type:	Sample ID Number:
Date:	Time:
Counting Instrument:	Sample Date:
Reading Units:	
Signature of Technician:	Date:
Signature of Reviewer:	Date:

510 NORTH PESHTIGO COURT
CHICAGO, ILLINOIS

STANDARD OPERATING PROCEDURE

Title: Field Logbook Procedure

Document: SOP-215

Revision Number: 0

Date: October 5, 2015 Replaces: New

FIELD LOGBOOK PROCEDURE

1.0 PURPOSE

This procedure describes standard protocol for the use and control of the Field Logbooks used during the Site remediation.

2.0 SCOPE

This procedure applies to field activities that are associated with the Site cleanup.

3.0 REFERENCES

None

4.0 EQUIPMENT AND MATERIALS

Field Logbook.

Indelible pen or pencil.

5.0 INSTRUCTIONS

5.1 Field Logbook Format

5.1.1 Prior to entering the field, page numbers shall be assigned to the pages of the Field Logbook. Pages shall include the date. Each Field Team Leader and other field personnel taking measurements, observing tests, or performing other related work will be issued a Field Logbook.

5.1.2 The first set of pages for a day will include the following items (in the order indicated):

- personnel on-site,
- contractor personnel on-site (names of employees for the companies represented),
- others on-site (e.g., regulators, visitors),
- weather,
- equipment used,
- equipment calibration,
- sketch of work area, and
- summary of work.

5.1.3 The remaining pages for a day will record the field activities and should include the following:

- meetings (meeting attendees, person who called the meeting, time, location, decisions, and decision makers),
- start and end time of activities,
- visits by others,
- regulator - directed activities,
- comments made by regulator, visitor, or other persons visiting Site,
- weather and working conditions,
- general description of work area,
- sketch work areas with significant relative locations, etc. shown,
- progression of work (e.g., faster or slower, reason for delays, etc.)

- description of equipment used, including general name, brand name, model number, and calibration, and
- description of amount of material excavated and levels of contamination observed (if known).

5.2 Quality Control

5.2.1 The Field Team Leader, or his designee, will review field logbook for completeness, proper field note correction (single line strikeout), and content.

5.2.2 Field logbooks will be audited at the discretion of the Project Quality Assurance Manager.

510 NORTH PESHTIGO COURT
CHICAGO, ILLINOIS

STANDARD OPERATING PROCEDURE

Title: Excavation Procedure

Document: SOP-217

Revision Number: 1

Date: December 16, 2015 Replaces: October 5, 2015

EXCAVATION PROCEDURE

1. PURPOSE

To provide a procedure for excavation for the Site.

2. SCOPE

This procedure will cover Site excavation activities, which are deemed quality critical by the Project Coordinator

3. REFERENCES

1992, NUREG/CR-5849, Manual for Conducting Radiological Surveys in Support of License Termination, Draft Report.

4. EQUIPMENT AND MATERIAL

None

5. INSTRUCTIONS

5.1 Delineation of extent

5.1.1 Delineate initial areas and depths. Areas and depths will extend slightly beyond estimated extent of contaminated fill or soil. Initial areal extent will be established using previously completed walkover gamma surveys, down-hole exploration and sampling information, supplemented with gamma survey data.

5.1.2 Initial excavation limits to be within three inches of the estimated bottom limit.

5.2 Excavate delineated fill or soil mass.

5.3 Sampling scheme

5.3.1 Re-establish survey grid.

5.3.1 Locate diagonals across grid square.

5.3.2 Survey the bottom of the excavation as described in Standard Operating Procedure (SOP)-210.

5.4 Pre-Verification or Verification Sampling

5.4.1 If all measurements within a grid are less than the removal action level, then grid is clean. No further excavation is required in this grid.

5.4.2 If any measurements within an excavation are greater than the removal action level, then additional excavation is required.

5.4.2.1 Proceed through sequence 5.2 through 5.4 again.

5.4.2.2 Mark subareas around grid points that exceeded the removal action limit.

5.4.2.2 Contact Field Team Leader for guidance of additional excavation.

5.5 Completion

5.5.1 After grid has met criteria, give documentation of delineation, excavation, and sampling to Field Team Leader.

5.5.2 Grid is available for Pre-Verification or Verification Surveying.

6. QUALITY CONTROL

6.1 Quality control for the excavation documentation will be in accordance with applicable SOPs.

510 NORTH PESHTIGO COURT
CHICAGO, ILLINOIS

STANDARD OPERATING PROCEDURE

Title: Verification Survey

Document: SOP-223

Revision Number: 1

Date: December 16, 2015

Replaces: October 5, 2015

VERIFICATION SURVEY PROCEDURE

1.0 PURPOSE

The purpose of this procedure is to present protocol for conducting verification surveys at the excavations at the Site.

2.0 SCOPE

This procedure applies to all completed excavations that are done as a result of the excavation area being identified as containing fill or soil exceeding the removal action level.

3.0 REFERENCES

SOP-210 - Gamma Radiological Survey

4.0 EQUIPMENT AND MATERIALS

None

5.0 PROCEDURE

5.1 Equipment and Materials

Equipment used for verification survey may include the following:

5.1.1 Compass or theodolite;

5.1.2 Cloth or steel tape; and

5.1.3 Stakes, survey flags, or spray paint.

5.2 Grid Layout

5.2.1 A confirmation/pre-verification and verification survey may be conducted at remediated excavations.

5.2.2 The grid size (40 x 40 feet or less) and locations used for the confirmation/pre-verification surveys will be essentially identical to those that will be established for the verification survey.

5.2.3 The diagonals across each grid square will be located.

5.2.4 The location halfway between the grid corner and the center of the grid will be located (Basically, the center of the four individual 20 x 20 feet quadrants.)

5.3 Confirmation/Pre-verification Sampling

5.3.1 Gamma field measurements will be made according to the procedures described for Gamma Radiological Surveys (SOP-210).

5.3.2 When all measurements within a grid are believed to indicate that the fill or soil is less than the removal action level, then grid is considered clean and a confirmation sample can be collected. If any field measurements within an excavation are greater than the removal action level, then the Field Team Leader shall guide additional fill or soil removal

until the excavation measures below the removal action level, and a confirmation sample can be collected and analyzed.

5.3.3 Sample Collection

5.3.3.1 The confirmation/pre-verification sample will be a composite sample made up of five subsamples obtained by dividing the 100 square meter area into four equal quadrants of 5 x 5 meter. Four of the subsamples will be collected from the center of the individual 5 x 5 meter quadrants, while the fifth subsample will be collected from the center of the 10 x 10 meter (or less) verification unit.

5.3.3.2 The material from the five sample aliquots will sifted through a 1/4" sieve to remove rocks, sticks, and other debris greater than 1/4" in size, then combined and homogenized in a stainless steel bowl.

5.3.3.3 Following homogenization, a properly sized aliquot of the homogenized material will be placed in an appropriate sample container(s): 20 milliliter (ml) for NUTRANL sample analysis or 500 ml for high resolution gamma spectroscopy analysis.

Note: Only one sample is being prepared for the confirmation/pre-verification NUTRANL analyses, versus the analysis of five samples for verification sample analysis.

5.3.4 Sample Analysis

5.3.4.1 This sample will then be analyzed using NUTRANL or high resolution gamma spectroscopy analysis.

5.3.4.2 If the composite sample analysis results indicate a combined Ra-226/Ra-228 concentration of less than 7.1 pCi/g, AECOM will contact the United States Environmental Protection Agency (USEPA) and request USEPA conduct the collection of a verification sample.

5.4 Verification Sampling

A verification sample shall be collected once gamma surveying and the confirmation/pre-verification sampling indicates that the base of excavation area is less than 7.1 pCi/g. Verification sampling will be conducted by the USEPA for each verification area not to exceed 1600 square feet (40 x 40 feet or less, square in shape or at least reasonably close).

5.4.1 Sample Collection

5.4.1.1 The verification sample will be comprised of a five point composite sample with individual sample aliquots collected from the diagonals and center point of the roughly 40 x 40 feet (or less) verification unit.

5.4.1.2 Diagonals will be established through each corner and intersecting at the center.

5.4.1.3 A total of five sample aliquots will be collected from each verification unit:

a. Four sample aliquots will be collected from the midpoint of each diagonal between a corner and the center.

b. One sample aliquot will be collected from the center of each verification unit.

c. Each sample aliquot volume should be at least 500 ml or of sufficient size to ensure there is enough material for a 500 ml sample following 1/4" screening.

5.4.1.4 The material from the five sample aliquots will sifted through a 1/4" sieve to remove rocks, sticks, and other debris greater than 1/4" in size, then combined, and homogenized in a stainless steel bowl.

5.4.1.5 Following homogenization, a properly sized aliquot of the homogenized material will be placed in an appropriate sample container: 100 ml for NUTRANL analysis (20 ml for each of five NUTRANL sample containers), or 500 ml for high resolution gamma spectroscopy analysis.

5.4.2 Verification Sample Analysis

5.4.2.1 The five individual verification samples will then be analyzed using NUTRANL or a single sample utilizing high resolution gamma spectroscopy analysis.

5.4.2.2 If verification sample analysis results indicate a combined Ra-226/Ra-228 concentration of less than 7.1 pCi/g, AECOM will provide to USEPA a "Notification of Successful Pre-Verification or Verification" form for the verification unit and request a final verification survey or approval to backfill (refer to attached form on page 5 of 5).

5.4.2.3 Upon request by the USEPA, the verification sample will be shipped to the USEPA National Air and Radiation Environmental Laboratory for final high resolution gamma spectroscopy analysis.

6.0 DOCUMENTATION

6.1 A scale drawing of the survey area showing the locations and results of the gamma measurements will be created.

6.2 The drawing and gamma measurements will be delivered to the USEPA with a Notice of Successful Verification and a request for approval to backfill the excavation (Form SOP 223-1).

7.0 QUALITY CONTROL

7.1 Quality control for the verification documentation will be in accordance with applicable Standard Operating Procedures (SOP).

For each verification unit of 1600 square feet or less (an area with dimensions of 40 x 40 feet or less, square in shape or at least reasonably close):

1. Once gamma surveying indicates that the base of excavations is likely less than 7.1 pCi/g, a verification sample shall be collected.

2. The verification sample will be comprised of a 5 point composite sample with individual sample aliquots collected from the diagonals and center point of the roughly 40 x 40 feet (or less) verification unit.

3. Diagonals will be established through each corner and intersecting at the center.

4. A total of five sample aliquots will be collected from each verification unit:

    a. Four sample aliquots will be collected from the midpoint of each diagonal between a corner and the center.

    b. One sample aliquot will be collected from the center of each verification unit.

    c. Each sample aliquot volume should be at least 500 ml or of sufficient size to ensure there is enough material for a 500 ml sample following 1/4" screening.

5. The material from the five sample aliquots will sifted through a 1/4" sieve to remove rocks, sticks, and other debris greater than 1/4" in size, then combined and homogenized in a stainless steel bowl.

6. Following homogenization, a properly sized aliquot of the homogenized material will be placed in an appropriate sample container: 100 ml for NUTRANL analysis (20 ml for each of five NUTRANL sample containers), or 500 ml for high resolution gamma spectroscopy analysis.

7. This verification sample will then be analyzed by AECOM using NUTRANL or high resolution gamma spectroscopy analysis.

8. If verification sample analysis results indicate a combined Ra-226/Ra-228 concentration of less than 7.1 pCi/g, AECOM will provide to USEPA a "Notification of Successful Pre-Verification or Verification" form for the verification unit and request a final verification survey or approval to backfill.

9. AECOM will then ship the verification sample to the USEPA National Air and Radiation Environmental Laboratory for final high resolution gamma spectroscopy analysis.

FORM 223-1
NOTIFICATION OF SUCCESSFUL VERIFICATION SURVEY

Area Identification: _____

Date of Verification Survey:_____

Time of Verification Survey: _____

The above-described excavation area was surveyed at the time and date indicated above. The survey indicated that all of the radiologically contaminated fill or soil within the above area has been removed as required by the Administrative Settlement Agreement and Order on Consent.

Documents pertaining to this survey are attached for review and approval by the USEPA.

Signed:

Date: _____

Print Name: _____

Print Title: _____

AECOM

The attached Verification Survey documents were reviewed by USEPA, Region 5 on _____. The results of this survey indicate that the removal action level has been met as contained in the Administrative Settlement Agreement and Order on Consent.

Authorization is hereby granted to commence backfilling and restoration work within the above excavation area.

Date: _____

Print Name: _____

Print Title: _____

For USEPA Region 5

510 NORTH PESHTIGO COURT
CHICAGO, ILLINOIS

STANDARD OPERATING PROCEDURE

Title: Radioactively Contaminated Material Shipments

Document: SOP-320

Revision Number: 1

Date: December 16, 2015 Replaces: October 5, 2015

RADIOACTIVELY CONTAMINATED MATERIAL SHIPMENTS

1.0 SCOPE

1.1 Purpose

To establish a procedure that will insure the safe and proper shipment of non-regulated radioactively contaminated waste material in compliance with United States Environmental Protection Agency (USEPA), Nuclear Regulatory Commission (NRC), Department of Transportation (DOT) regulations as well as the Waste Acceptance Criteria of the disposal site.

1.2 Applicability

This procedure is applicable for shipments of radioactively contaminated materials destined for disposal at either U.S. Ecology Idaho, Inc. in Grand View, Idaho; Waste Control Specialists, LLC in Andrews, Texas or EnergySolutions, LLC located in Clive, Utah.

2.0 REFERENCES

- 32 Illinois Administrative Code (IAC), Parts 310 and 340, Standards for Protection Against Radiation
- 32 IAC, Part 400, Notices, Instructions and Reports to Workers; Inspections
- 10 CFR Part 71.47 and 71.87
- 10 CFR Part 71 Statements of Consideration
- 49 CFR Parts 172, 173, 174 and 177
- 32 IAC, Part 341, Transportation of Radioactive Material

3.0 DEFINITIONS

3.1 Definitions for transport are defined in 49 CFR §173

3.2 Limited Quantity of Radioactive Material

This is the quantity of radioactive material that does not exceed the materials package limits specified in 49 CFR 173.425 and which conforms with the requirements specified in 49 CFR 173.421.

4.0 REQUIREMENTS

4.1 Prerequisites

4.1.1 All shipping packages shall be inspected by the Project Coordinator or designee prior to loading to insure that the container's integrity is adequate and then inspected again after loading to insure that the packages have been loaded and closed in accordance with applicable procedures.

4.1.2 For shipments of radioactively contaminated material for disposal, compliance with disposal site facility criteria and specific state and federal license provisions applicable to the material shall be verified by Project Coordinator or designee.

4.1.3 For packages of radioactively contaminated waste material intended for disposal, the Project Coordinator or designee shall verify that the pre-shipment characterization process has been completed.

4.2 Tools, Material, Equipment include the following

4.2.1 Packaging, labels and containers as applicable.

4.3 Precautions/Limits

4.3.1 Radioactive waste material that is to be shipped for disposal must be classified according to 32 IAC 340.1052 and meet the requirements of 32 IAC 340.1055 if it is going to be shipping as a hazardous material.

4.3.2 The maximum permissible limits for removable contamination for a package are contained in 49 CFR 173.443 Table 9. Pursuant to 49 CFR 173.443(a)(1), the values in the Table below assume a wipe efficiency of 10% (i.e., are the 49 CFR 173.443 Table 9 values divided by 10).

Table 1 - Non-Fixed External Radioactive Contamination Wipe Limits for Packages

Contaminant	Bq/cm^2	$\mu Ci/cm^2$	Dpm/cm^2
Beta/gamma emitting nuclides; nuclides with $T_{1/2}$ <10 days; natural uranium; natural thorium; U-235; U-238; Th-232; Th-228; and Th-230 when contained in ores or physical concentrates.	0.4	10^{-5}	22
All other alpha emitting nuclides	0.04	10^{-6}	2.2

NOTE: In cases of packages transported as exclusive use shipments by rail or highway, the non-fixed radioactive contamination must not exceed the above wipe limits at the beginning of transport, and, at any time during transport, must not exceed 10 times the above wipe limits (please refer to 49 CFR 173.443 for complete details on contamination control and exclusive use shipments).

4.3.3 The radiation levels at any point on the external surface of the package must not exceed 200 millirem per hour (mrem/hr) and the Transport Index must not exceed ten. Packages transported as exclusive use by rail or highway may exceed these limits provided that the following conditions are met:

Table 2 – External Surface Dose Rate Limits

	Open Vehicle	Closed Vehicle
Package Surface	≤ 200 mrem/hr	≤ 1000 mrem/hr
Vehicle	≤ 10 mrem/hr at 2 meters from vertical planes	≤ 200 mrem/hr at any point on the outer surface of the vehicle ≤ 10 mrem/hr at 2 meters from vertical planes ≤ 2 mrem/hr in cab

4.4 Acceptance Criteria

4.4.1 Radioactively contaminated material has been properly prepared, packaged, and loaded onto a vehicle and is in proper condition for transport.

4.4.2 All necessary forms, surveys, and manifests have been prepared and the "shipping papers" packet is complete.

4.4.3 All necessary state and local authorities and material receivers have been properly

notified of the shipment.

4.4.4 All necessary paperwork has been completed and signed, and a copy of the "shipping papers" packet has been filed for project records.

4.4.5 For radioactive waste shipments for disposal, confirmation of receipt at the disposal facility is acknowledged within 20 days of shipment, or an investigation is initiated.

5.0 PROCEDURE

5.1 Verify that the intended consignee (receiver) of the material has a valid license to accept the type and quantity of radioactively contaminated material.

NOTE

Typically, groundwater samples, surface water samples, and environmental air samples that are shipped offsite do not meet the regulatory definition of "Radioactive Material" and, therefore, do not require radioactive material shipping paperwork.

5.2 Determine the following information for inclusion on the shipping manifests for each package in the intended shipment:

5.2.1 Verify that the proper shipping name will be DOT Non-Regulated Material, Non-Hazardous Soil

5.2.2 Physical and chemical form of material.

5.2.3 For each shipment of radioactively contaminated material, emergency response information must be maintained during transportation and at facilities where hazardous materials are loaded for transportation or otherwise handled during any phase of transportation.

5.3 If the package of radioactively contaminated material is to be shipped for disposal, the following are additional required steps:

5.3.1 Verify the waste material meets the relevant disposal facility's acceptance criteria.

5.3.2 For shipments to US Ecology, use a Non-Hazardous Waste Manifest. For shipments to WCS, use a Hazardous Waste Manifest (note: material is "non-regulated" but is required, per Texas regulations, to be shipped on a Uniform Hazardous Waste Manifest). Use EnergySolutions Radioactive Waste Shipment and Disposal Record forms 540 and 541 as the manifest forms for all shipments of radioactive waste material going to EnergySolutions.

5.3.3 The disposal site operator is required to acknowledge receipt of the shipment within 7 days of arrival by returning a signed copy of the first page of the shipping manifest to the shipper.

5.3.4 Verify that the radioactive material has been properly prepared, packaged, marked, labeled, and loaded on the vehicle.

5.3.5 Ensure that package radiation and contamination surveys have been performed and documented if applicable, and that package radiation and contamination levels are within the limits specified in Section 4.3.

5.3.6 Ensure that the load on the vehicle has been properly strapped down and tarped so as to

sufficiently restrain from movement during normal transport.

5.3.7 Contact the Project Coordinator, or his designee, for final inspection of the vehicle, cargo and paperwork.

5.3.8 Insure that the carrier (vehicle operator) has all the required shipment papers, and appropriate copies have been retained for the site files.

6.0 RECORDS/REPORTS/NOTIFICATIONS

6.1 Shipping records shall be maintained by the Project Coordinator or designee. A complete shipment record packet includes copies of all completed and signed paperwork that accompanied the shipment.

6.2 Anyone who observes a deficiency in complying with this procedure shall notify Project Coordinator or his designee.

7.0 ATTACHMENTS

Attachment 1	Emergency Procedure Form
Attachment 2	Evaluation Questionnaire Form

ATTACHMENT 1
EMERGENCY PROCEDURE

This vehicle contains _fill, soil or demolition debris_, which are contaminated with natural thorium. In the event of an accident involving spillage of radioactively contaminated material, the following actions are recommended, if appropriate:

1. LIFESAVING, RESCUE AND FIREFIGHTING

This may be done with little fear towards the hazards from the material contaminated with thorium. If possible, avoid breathing dust and avoid swallowing it. Thorium on the skin or clothing is relatively harmless and simple washing methods will remove it. If you come into contact with the debris, please wait for advice from health officials. To avoid ingestion of thorium, do not eat, drink, or smoke while near the spill.

2. CONTACT THE LOCAL LAW ENFORCEMENT AGENCY

Tell the police of the accident with spillage of "Non-regulated radioactively contaminated (thorium) material". Ask them to notify the state health department. Give them the location of the accident site and tell them of any injuries to persons.

3. FILL OUT ATTACHED QUESTIONNAIRE

Please obtain all of the information asked for on the attached form. You will need to relay this information to the carrier and the shipper.

4. Telephone the Carrier and Shipper (call collect)

   a) The Trucking Carrier is: _____
   Telephone No.: _____

   b) The Shipper is:
   Telephone No._____

Read the completed questionnaire to whoever answers your calls. It may be necessary to read the questionnaire a second time for complete understanding.

5. When help arrives please cooperate with all Civil Authorities and Carriers and Shipper's personnel who arrive at the scene. Follow their health safety instructions for checking possible contamination of your clothing or body.

   Please be assured that your exposure to this material will be relatively harmless, particularly if you have followed these instructions. The health and safety personnel who will arrive will be glad to answer any questions you have about this matter

ATTACHMENT 2
EVALUATION QUESTIONNAIRE

1. Name of truck driver

2. Name of trucking company _____

3: Bill of lading number

4. Destination of shipment_____

5. Date and time of accident _____

6. Place of accident_____

7. Name of Police Department notified _____

8. Phone Number of Police notified _____

9. Is the driver injured? _____ Others? _____

10. Is or was there a fire? _____

11. Is the truck road worthy?_____

12. Are containers off of the truck? _____ How many? _____

13. Estimate the number of square feet of spilled material_____

14. Has the spill been covered? _____

15. Is the spill on the ground? _____ Pavement? _____
16. Is the spill in water? ☐ Yes ☐ No **Lake**? ☐ Yes ☐ No **Stream**? ☐ Yes ☐ No
17. Is the spill near a building? ☐ Yes ☐ No **Sewer**? ☐ Yes ☐ No

18. Is the accident place illuminated at night? _____

19. Other comments:_____

20. Where can you be reached by phone?_____

a) Near the accident site _____
b) Home or business phone _____
c) Your name: _____

510 NORTH PESHTIGO COURT
CHICAGO, ILLINOIS

STANDARD OPERATING PROCEDURE

Title: Operation of Ludlum Model 2221 Scaler/Ratemeter with Ludlum Model 44-10 2”x2” NaI Scintillation Probe

Document: SOP-343

Revision Number: 1

Date: December 16, 2015 Replaces: October 5, 2015

Operation of Ludlum Model 2221 Scaler/Ratemeter with Ludlum Model 44-10 2"x2" NaI Scintillation Probe

1.0 SCOPE

1.1 Purpose

The Ludlum Model 2221 Scaler/Ratemeter with Ludlum Model 44-10 2"x2" Scintillation Probe is used to perform gamma radiological screening surveys over fill or soil surfaces. In addition to screening surveys, the instrument can collect integrated count rate data at fixed locations

1.2 Applicability

The Ludlum Model 2221 Scaler/Ratemeter with Ludlum Model 44-10 2"x2" Scintillation Probe is used to perform gamma radiological screening in accordance with SOP 210 "Gamma Radiological Screening Surveys".

2.0 REFERENCES

2.1 Ludlum Model 2221 Scaler/Ratemeter Operation Manual

3.0 EQUIPMENT AND MATERIALS

The following equipment may be used as part of the survey programs. Other equipment may be substituted if necessary because of availability of the items listed or the conditions encountered at the site.

- Ludlum Model 2221 Scaler/Ratemeter
- Ludlum Model 44-10 2"x2" NaI Scintillation Detector
- NIST Traceable Radiation Check Source

4.0 PROCEDURE

4.1 Check for Current Calibration Sticker

4.1.1 Survey Meter shall be calibrated within the last 12 months and be affixed with a current calibration sticker. Meter shall be calibrated according to manufacturer's instructions with appropriate NIST traceable sources.

4.2 Check Batteries

4.2.1 Press the "BAT" button

4.2.2 The digital readout should read greater than "5.0". Record result on "Daily Radiation Survey Instrument Function Check" form (see Attachment 1).

4.2.3 Replace 4 D batteries if needed before use.

4.3 Verify Background

4.3.1 Set control switch to "DIG RATE".

4.3.2 Go to an area away from Exclusion Zone or where radioactive contamination is not present. Record result on "Daily Radiation Survey Instrument Function Check" form (see Attachment 1).

4.3.3 Site Specific background count rates shall be established for each instrument prior to initiating excavation activities.

4.3.4 Compare the observed count rate to the pre-established background count rate.

4.3.5 Do not use the meter if the observed count rate varies greater than +/- 10% from the pre-established background count rate unless it can be established appropriately why background conditions have changed.

4.4 Perform Meter Operation Check

4.4.1 Set control switch to “SCALER”

4.4.2 On the calibration sticker the operation check value will be noted and the survey configuration required to perform the check.

4.4.3 Place detector probe on top of the check source holder.

4.4.4 Press “Count” to collect a one minute integrated count.

4.4.5 Record operational check reading indicated on the digital readout. Record result on “Daily Radiation Survey Instrument Function Check” form (see Attachment 1).

4.4.6 Observed reading should be within +/- 10% of recorded operational check value.

4.4.7 Do not use the meter if the operational check fall outside of the acceptable range

4.5 Performing Radiation Surveys

4.5.1 Set Control switch to “DIG RATE”

4.5.2 Hold the probe at a consistent height no further than 6 inches away from surface being surveyed

4.5.3 Move the probe slowly over the surface being surveys at a rate of no more than 0.5 meter per second.

4.5.4 Walk over survey area with spacing between passes not to exceed 1 meter.

4.5.5 Record count rates, as needed.

5.0 **RECORDS/REPORTS/NOTIFICATIONS**

Refer to SOP-210 for documentation required when performing Gamma Radiological Screening Surveys.

ATTACHMENT 1

LUDLUM MODEL 2221 DAILY RADIATION SURVEY INSTRUMENTATION FUNCTION CHECK

Instrument Serial Number: _____

Probe Model Number: _____

Probe Serial Number: _____

Check Source ID Number: _____

Acceptable Source Count Rate (+/- 10%): _____

Acceptable Background Count Rate (+/- 10%): _____

Date	Time	Physical Check	Battery Check	Background Counts (CPM)	Source Counts (CPM)	Performed By (Initials)

510 NORTH PESHTIGO COURT
CHICAGO, ILLINOIS

STANDARD OPERATING PROCEDURE

Title: Surveys for Surface Contamination and Release of Equipment for Unrestricted Use

Document: SOP-345

Revision Number: 0

Date: October 5, 2015 Replaces: New

SURVEYS FOR SURFACE CONTAMINATION AND RELEASE OF EQUIPMENT FOR UNRESTRICTED USE

1.0 SCOPE

1.1 Purpose

This procedure provides the methods for the detection and measurement of radioactive contamination within the site areas, it provides the methods for evaluating contamination, and establishes the criteria for releasing equipment or materials out of the Exclusion Zone. These methods are to be used to minimize the spread of radioactive contamination.

1.2 Applicability

This procedure applies to surveys that are performed on building surfaces, vehicles, equipment, materials (herein referred to as equipment) at the site and to the site personnel, who are required to monitor and release the equipment.

2.0 REFERENCES

2.1 10 Code of Federal Regulations (CFR) Part 20 Standards for Protection Against Radiation

2.2 U. S. Nuclear Regulatory Commission (USNRC) Regulatory Guide 1.86

2.3 Site Health and Safety Plan

2.4 NUREG CR5849 Manual for Conducting Radiological Surveys in Support of License Termination

3.0 DEFINITIONS

3.1 Beta-Gamma to Alpha Decay Ratio

A thorium-232 decay series produces about 0.5 beta-gamma decays for every one alpha decay. This ratio allows the limits for alpha contamination to be verified using beta-gamma survey instruments.

3.2 Clean Area

This term defines radiation conditions within a specified area. An area where the radiation levels and contamination levels are maintained below 2 mrem/hr and 33 disintegrations per minute (dpm)/100 square centimeters (cm^2) alpha respectively.

An assessment that may include, as appropriate, surveys for loose and fixed contamination through the use of direct frisks, large area wipes and smears, to locate and quantify the radioactive material present.

3.4 Exclusion Zone

The area on one side of the Control Line that includes Contamination Control Areas, Radiation Areas, and Airborne Radioactivity Areas.

3.5 Large Area Wipes (LAWs)

Paper towels or muslin used to wipe large areas to identify the presence of loose contamination.

3.6 Lower Limit of Detection (LLD)

The smallest amount of a radionuclide in a sample that will be detected with a probability of non-detection (Type I error) while accepting a probability of erroneously detecting that radionuclide in a blank sample (Type II error). These probabilities are 0.05 (5% chance of Type I or II errors). See Attachment 5 - "LLD Calculation" sheet.

3.7 Smears

Typically 2 inch disk type paper material. Smears are normally taken to identify and quantify loose contamination.

3.8 Unrestricted Release

Release of equipment or materials from the Exclusion Zone to any destination other than a licensed facility.

4.0 REQUIREMENTS

4.1 Prerequisites

4.1.1 Health Physics personnel shall ensure that all portable survey equipment used for this procedure are properly functioning and have a valid calibration sticker.

4.1.2 The Health Physics Supervisor or designee shall ensure that all personnel who are required to perform this procedure are properly trained and understand this procedure.

4.1.3 Equipment, vehicles and areas should be free of visible dirt, mud or dust prior to performing a contamination survey.

4.2 Tools, Material, Equipment

4.2.1 The following counting equipment, or their equivalents, should be used for performing contamination surveys on equipment and materials:

- Personnel and Equipment Frisking: Ludlum Model 3 Survey Meter with attached pancake G-M probe.

- Alpha Smear Counting: Ludlum 2200 Scaler with attached Model 43-10 Alpha Scintillation Counter.

4.2.2 Survey Maps (or lists) should be produced for each applicable type of equipment. Sketches of building surfaces (walls, floors, etc.), identifying the surveyed grids, should be produced for each surveyed building.

4.3 Precautions, Limits

4.3.1 Direct and removable surveys should not be performed on wet surfaces for alpha contamination. Wet surfaces should be surveyed only for beta-gamma contamination. However, the Health Physics Supervisor shall make the final determination as to when a wet surface is to be surveyed.

4.4 Acceptance Criteria

4.4.1 Prior to unrestricted release from the Exclusion Zone, all vehicles, equipment and materials shall be surveyed for contamination. If contamination is found, then the vehicle, equipment, or material should be decontaminated in order to be within the applicable

surface contamination release limits per Attachment 3. Attachment 6 (Beta-Gamma Survey of Truck Tires) shall be used as a guideline for meeting Department of Transportation (49CFR173.443) release criteria, when performing surveys on wet surfaces.

4.4.2 The release of items from clean areas within the Exclusion Zone will be controlled by specific criteria established on a case by case basis and approved by the Health Physics Supervisor.

5.0 PROCEDURE

5.1 Routine Surface Contamination Surveys

5.1.1 Routine surveys shall be performed by trained personnel (typically by Health Physics Technicians), in accordance with this procedure and as scheduled by the Health Physics Supervisor.

5.1.2 Routine contamination surveys are not required in the Exclusion Zone.

5.1.3 Support Zone and Contamination Reduction Zone shall be surveyed at least weekly to ensure that cross-contamination is not occurring. The clean side of the Contamination Reduction Zone should be surveyed each work day.

5.1.4 Other surveys will be performed, as appropriate, to support Special Work Permits, the movement of equipment from radioactive material areas to clean areas, and to evaluate radiological conditions in specific work areas when directed by the Health Physics Supervisor.

5.2 Support/Contamination Reduction Zone- Surface Contamination Surveys

5.2.1 Survey techniques may employ the use of large area wipes, smears, or direct frisks as appropriate to the area being surveyed.

5.2.2. Large area wipes may be used to assess floor areas for contamination. A sufficient number of large area wipes should be used to evaluate approximately 10% of the floor area being surveyed.

5.2.3 If contamination is found with the large area wipes, a more detailed smear survey should be performed.

5.2.4 Counter tops, office furniture, laboratory equipment, etc., should be included in the contamination surveys. The area immediately on the clean side of the Control Line should be included in the survey.

5.2.5 Smears shall cover approximately 100 cm^2 and should focus on areas with the highest potential for removable contamination. The smears should be placed in an envelope that is labeled with a sequential number corresponding to the Smear Number on the Radiological Survey Data Sheet (see Attachment 1).

5.2.6 The smears shall be analyzed for alpha contamination.

5.3 Equipment-Surface Contamination Surveys

5.3.1 Equipment shall be surveyed for contamination by using large area wipes, smears and by direct frisk as appropriate.

5.3.2 Take an appropriate number of smears to adequately assess the radiological conditions of the item being surveyed.

5.3.3 A large area wipe may be used as an indication of the presence of contamination.

5.3.4 Smears shall cover approximately 100 cm^2 and should focus on areas with the highest potential for removable contamination. The smears should be placed in an envelope that is labeled with a sequential number corresponding to the Smear Number on the Radiological Survey Data Sheet (see Attachment 1).

5.3.5 The smears shall be analyzed for alpha contamination.

5.4 Unrestricted Release

5.4.1 Materials, equipment and vehicles shall be surveyed for contamination prior to unrestricted release from the site, using large area wipes, smears, and by direct frisk.

5.4.2 All building surfaces, large concrete pieces, and other materials having large, smooth surfaces shall be surveyed prior to unrestricted release. A sufficient number of large area wipes and/or smears shall be taken to adequately assess any contamination present.

5.4.3 All equipment intended for unrestricted release from contaminated areas shall be surveyed for removable and fixed contamination. A sufficient number of large area wipes and/or smears shall be taken to adequately assess any contamination present. If removable contamination is within the release criteria, then perform a direct alpha frisk. Particular attention should be given to areas of the vehicle most likely to have become contaminated such as tire exterior surfaces, occupied areas, load areas, wheel wells, and the bottom of the equipment.

5.4.4 Vehicles intended for unrestricted release from contaminated areas shall be surveyed for removable contamination with large area wipes. If no contamination is found, take a confirmatory smear to document each large area wipe. If contamination is found, take an appropriate number of smears to evaluate the removable contamination present. If removable contamination is within the release criteria, then perform a direct alpha frisk. All survey results must be documented.

5.4.5 Vehicles intended for unrestricted release from clean areas in the Exclusion Zone shall be surveyed with large area wipes on accessible tire/track surfaces, with a direct frisk of tire/track surfaces, and with one smear each for two tires The results of the direct frisk and the large area wipes must indicate that the release criteria is met. The smears shall be added to the survey documentation when the results become available.

5.4.6 Large area wipes may be used as an indication of the presence of contamination.

5.4.7 If no contamination is found with a large area wipe, a confirmatory smear shall be taken for documentation.

5.4.8 If contamination is found with the large area wipe, a representative number of smears shall be taken to quantify the removable contamination present.

5.4.9 Smears shall cover approximately 100 cm^2 and should focus on areas with the highest potential for removable contamination. The smears should be placed in an envelope that is labeled with a sequential number corresponding to the Smear Number on the Radiological Survey Data Sheet (see Attachment 1).

5.4.10 The smears shall be transported to the Site laboratory for analysis.

5.4.11 Perform a direct frisk on all material being surveyed for unrestricted release.

5.4.12 Personal equipment and articles (radios, pens, paper, clipboards, etc.) can be surveyed with either the large area wipes or by direct frisk, as appropriate.

NOTE
Items that have irregular surfaces, such as radios, should be wiped and frisked. Items with relatively smooth surfaces, such as paper, pens, etc., may be direct frisked only.

5.5 Documentation of Results

5.5.1 The smear counting results and data shall be documented on the Radiological Survey Data Sheet (see Attachment 1). The documentation of the release survey shall include a drawing of the item to be released.

5.5.2 The instructions for completion of the Radiological Survey Data Sheet are contained in Attachment 2.

5.5.3 A request for equipment release form (Attachment 7) shall be initiated by the equipment owner to track the decontamination process.

6.0 RECORDS/REPORTS/NOTIFICATIONS

6.1 The Health Physics Supervisor and the Project Coordinator shall review and approve all completed survey forms required by this procedure, to comply with reference 2.5 above.

6.2 The survey maps shall be uniquely numbered and retained by Health Physics for project filing. Single item survey maps shall be attached to the survey results.

7.0 ATTACHMENTS

7.1 Attachment 1 - Radiological Survey Data Sheet

7.2 Attachment 2 - Radiological Survey Data Sheet Instructions

7.3 Attachment 3 - Surface Contamination Release Limits

7.4 Attachment 4 - Large Area Wipes on Truck Tires

7.5 Attachment 5 - LLD Calculation

7.6 Attachment 6 - Beta-Gamma survey of Truck Tires

7.7 Attachment 7 - Request For Equipment Release

Attachment 1

RADIOLOGICAL SURVEY DATA SHEET

Page ___of ___

Item Description	00 ____Vehicle		98 _____Equipment		_____ _____Building ___ Other	
Reference	YR	MO	Day	Item	No.	Performed By:
Alpha Survey Instrumentation				Beta Survey Instrumentation		

Location	Smear Number	Alpha Activity (dpm/100cm^2)		Beta Gamma Direct (CPM)
		Direct	Removable	Fixed

REMARKS

Reviewed By:	Date:

ATTACHMENT 2

RADIOLOGICAL SURVEY DATA SHEET INSTRUCTIONS

I. Select the appropriate survey category.

2. Enter the purpose of the survey in the "ITEM DESCRIPTION" section. Be specific:

- Vehicle survey for release from the site.
- Tools and equipment for use in the clean area.
- SWP support, include the SWP number.

3. Enter the survey date.

4. Enter the reference number - Year, Month, Date, Item (Use coding for categories at the top of the form) and Number.

5. Enter your signature in the "PERFORMED BY" section.

6. Enter the instrument(s), serial number(s), and background reading(s) for the survey instruments used for this survey.

7. Enter the "LOCATION OF READING." Enter descriptions such as, the location and item being surveyed, vehicle number, smear location on vehicle, etc.

8. Enter the number of the smear or large area wipe in the "SMEAR NUMBER" section.

9. All data in the "ALPHA ACTIVITY" section is recorded in disintegrations per minute (dpm)/100 cm^2, except large area wipe data.

- If equipment/material is directly frisked, the reading from the Ludlum Model 3 with pancake G-M probe is converted to dpm)/100 cm^2 by multiplying corrected counts per minute (ccpm) by a factor of 4 (Gross cpm - Background cpm X 4) and enter the result in the "DIRECT" column. If the instrument response cannot be distinguished from background enter <200 dpm/I00cm^2.

- The "REMOVABLE" column may contain the result from a smear or the result from a large area wipe. Smear results that are less than the LLD shall be recorded as less than the numerical LLD value for the instrument in use. As an example, if the LLD for the 65000 is 3 dpm, then the result will should be recorded as <3 dpm/100cm^2. All results should be rounded to the nearest whole number. Results from LAWs should be recorded as dpm without regard to area, unless specific instructions are given to calculate the result per area, as in Attachment 4. Results that do not exceed background should be recorded as BKG (Background).

- Fixed contamination is the difference between the direct frisk results and the removable contamination results. If no fixed contamination is detectable, enter N/A in the "FIXED" column.

10. If a "BETA-GAMMA DIRECT" survey is performed, record the results as ccpm.

11. In the "REMARKS" section, record any identifying data on counting equipment and any other information needed for explanation or interpretation of survey data. If large area wipes are included in the removable contamination data without regard to area, note this in the "REMARKS" section.

ATTACHMENT 3

SURFACE CONTAMINATION RELEASE LIMITS

Average[a] Removable (dpm/100 cm^2)	Maximum Removable (dpm/100 cm^2)	Average[a] Fixed (dpm/100 cm^2)	Maximum Fixed (dpm/100 cm^2)
20	100	1,000	5,000
Equivalent Beta-Gamma Measurements [b,c]			
17	50	500	2,500

a The contamination levels may be averaged over one (1) square meter provided the maximum activity per any 100 cm^2 area within the one (1) square meter is less than the maximum applicable release limit.

b Beta-gamma release limits derived from the beta-gamma to alpha ratio.

c Beta-gamma surveys are not normally performed for release purposes. If alpha contamination is verified to be within specified release limits, the alpha to beta-gamma ratio indicates that the beta-gamma is also within limits.

Beta-gamma frisks may be used as appropriate to:

- Estimate contamination levels prior to performing release surveys.
- Estimate levels of contamination present on equipment, materials and work areas.

The results of direct beta-gamma frisks should be quantified on survey records as ccpm.

Results that are less than 100 ccpm should be recorded on the survey record as <100 ccpm.

ATTACHMENT 4

LARGE AREA WIPES ON TRUCK TIRES

Large area wipes are used to wipe an area of approximately 2,000 cm^2 on truck tires. The wipes are then frisked with a PAC-4G.

Assuming that 50 cpm above background is readable, it can be assumed that 100 dpm is detectable on a wipe. If the area of the wipe requires two probe areas to cover the wipe, then it can be assumed that we can assess with each measurement approximately half of the total area wiped, or 1000 cm^2 or approximately 100 dpm/1,000 cm^2, which is equivalent to 10 dpm/100cm^2.

Frisk results on LAWs, from truck tires, that are nondetectable may be recorded as <10 dpm/100cm^2 in the removable column of the survey report.

ATTACHMENT 5

LOW LIMIT OF DETECTION (LLD) CALCULATION

$$LLD = \frac{2.71}{T_s} + 3.29\sqrt{\left(\frac{Cb}{Tb}\right)\left(1+\frac{Tb}{Ts}\right)}$$

Where C_b = Background Counts Per Minute
T_b = Background Counting Time in minutes
T_s = Sample Counting Time in minutes

EXAMPLE: The background count rate for a given counter is 1.56 cpm over a 50 minute counting time and samples are counted for 2 minutes. The counter has an efficiency of 40.3%.

$$LLD = \frac{2.71}{2} + 3.29\sqrt{\left(\frac{1.56}{50}\right)\left(1+\frac{50}{2}\right)}$$

LLD = 4.32 cpm

$$LLD = \frac{4.32 \text{ cpm}}{.403} = 10.7 \text{ dpm}$$

ATTACHMENT 6

BETA-GAMMA SURVEY OF TRUCK TIRES

The Department of Transportation removable contamination limits in 49 CFR 173.443 are 220 dpm alpha contamination and 2200 dpm beta contamination. The most restrictive is the alpha limit. If weather prevents surveying for alpha contamination, then beta-gamma surveys will have to be utilized. The alpha to beta ratio for the thorium chain is approximately 2:1. Using an alpha to beta ratio of 2, the beta equivalent activity for the alpha limit would equal 110 dpm. 110 dpm times the probe efficiency of 0.14 cpm/dpm equals 15.7 cpm. 15.7 cpm above background is not discernable in the field. The diameter of a truck tire is 43 inches. The tread width is 9 inches. The surface area of a truck tire equals 7843.8 cm^2. Approximately 12 inches of tread is on the ground and not surveyable. This represents 3.5% of the surface area of the tire. The remaining 96.5% equals a surface area of 7569.5 cm^2. The typical area of contact for a wipe is about 3.5 inches by 4 inches. This is equal to about 90 cm^2. If the conservative area of 100 cm^2 is used the each cm^2 of wipe is equal to 57.7 cm^2 of tread area. The manufacturer lists the surface area of the probe face as 15.5 cm^2. The tread area survey under the probe equals 894.4 cm^2. To correct the measured counts to an activity/100 cm^2 the counts indicated on the meter face must be multiplied by 8.9. If 15.7 cpm/100 cm^2 beta-gamma activity equals 220 dpm/100 cm^2 alpha contamination then the measured cpm when surveying a wipe would equal 139 cpm. The manufacturer recommends limiting the background count rate to less than 300 cpm in order to see 100 cpm above background. Due to the changing background conditions this value is being reduced to 200 cpm. Therefore, if background is 200 cpm or less and the wipe on a truck tire reads less than 100 cpm above background the truck tire has less than 220 dpm/100 cm^2 removable alpha contamination.

ATTACHMENT 7
REQUEST FOR EQUIPMENT RELEASE

From:_____ Date: _____

TO: HEALTH PHYSICS SUPERVISOR

1. Equipment Type and ID # _____

2. Usage History (locations on site)

_____
_____
_____

3. Scheduled Date to Start Decontamination _____

4. HP Check for Survey Readiness: Technician _____ Date_____

5. Equipment ready for survey ☐ YES ☐ NO

Actions required _____
_____
_____

6.Date and Time Ready for Survey_____

7. Survey Date and Time _____

Results: Pass _____ Fail_____

8. Equipment Release Date _____

9.Approved for Release: HP Supervisor: _____ Date: _____

NOTE; On large earth moving equipment, substantial cleaning may be required prior to HP checking for survey readiness. Once vehicle has been checked and is ready for release survey, it may take as much as 24 hours from the time the survey is initiated until survey results are available. If fixed or removal is located, additional decontamination and surveys are required.

510 NORTH PESHTIGO COURT
CHICAGO, ILLINOIS

STANDARD OPERATING PROCEDURE

Title: Decontamination

Document Number: SOP-347

Revision Number: 1

Date: December 16, 2015 Replaces: October 5, 2015

DECONTAMINATION

1.0 SCOPE

1.1 Purpose

The purpose of this procedure is to provide instructions for the decontamination of personnel and equipment.

1.2 Applicability

This procedure is applicable for all equipment and personnel that may become contaminated at the project Site.

2.0 REFERENCES

10 Code of Federal Regulations (CFR) Parts 19 and 20

United States Nuclear Regulatory Commission (USNRC) Regulatory Guide 1.86

Health and Safety Plan, 510 N Peshtigo Ct., Chicago, IL

Standard Operating Procedure (SOP)-345 "Surveys for Surface Contamination and Release of Equipment for Unrestricted Use"

3.0 DEFINITIONS

3.1 Airborne Radioactivity Area

This term defines radiation conditions within a specified area. An area where the average concentration of airborne radioactivity could allow an individual to exceed 12 Derived Air Concentration (DAC) hours (hrs) over a one week period.

3.2 Clean Area

This term defines radiation conditions within a specified area. An area where the radiation levels and contamination levels are maintained below 2 millirem per hour (mrem/hr) and 33 disintegrations per minute (dpm)/100 square centimeters (cm^2) (about 15-in^2) alpha, respectively.

3.3 Contamination Control Area

This term defines radiation conditions within a specified area. An area that may be contaminated to a level greater than a Clean Area.

3.4 Contamination Reduction Zone

The term defines the area on one side of the Control Line where personnel can decontaminate and remove their personal protective clothing and equipment.

3.5 Control Line

The term defines the demarcation that separates a Clean Area from a Contamination Control Area. The control line is located in the personnel decon facility.

3.6 Craft Personnel

Craft personnel are employees and contractors who physically perform the activities described on the Special Work Permit (SWP).

3.7 Derived Air Concentration-Hour (DAC-hour)

DAC-hour is the product of the concentration of radioactive material in air and the time of exposure to that radionuclide.

3.8 Exclusion Zone

The exclusion zone is the area on one side of the Control Line that includes Contamination Control Areas, Radiation Areas, and Airborne Radioactivity Areas.

3.9 Film Badge

Similar to the Thermoluminescence Dosimeter (TLD), a film badge is used to measure radiation dose.

3.10 Frisking

Frisking is a personal survey of an individual's clothing and exposed body performed to determine if contamination is present.

3.11 Protective Clothing

Protective clothing is reusable or disposable coveralls, boots and gloves that provide a barrier between contamination and personnel.

3.12 Radiation Area

This term defines radiation conditions within a specified area. An area where the whole body radiation level is greater than 5 mrem/hr.

3.13 Special Work Permit (SWP)

A SWP is a document which describes the radiological conditions of the work area or task and delineates safety and radiation protection requirements to be followed in the work area or when performing the task.

3.14 Support Zone

The support zone is an area on one side of the Control Line at the entrance to the Exclusion Zone.

3.15 Optically Stimulated Luminescence Dosimeter (OSL)

OSL is a device that measures radiation dose.

4.0 REQUIREMENTS

4.1 Prerequisites

None.

4.2 Tools, Material, Equipment requirements are as follows:

4.2.1 Decontamination facility and

4.2.2 Soap, water, high pressure spray, scrub brushes and other material as necessary to decontaminate personnel and equipment.

4.3 Precautions, Limits

Decontamination of personnel with material other than soap and water will only be done when authorized by the Site Manager, Health Physics Supervisor, or a medical doctor.

4.4 Acceptance Criteria

4.4.1 Personnel shall be free of contamination after decontamination.

4.4.2 Material and equipment being decontaminated for unrestricted release shall meet the release limits established in Reference 2.4.

5.0 PROCEDURE

5.1 Personnel Decontamination

5.1.1 Personnel who are contaminated to greater than 100 corrected counts per minute (ccpm) shall notify the health physics technician (HPT) assigned to the Control Line.

5.1.2 The HPT shall resurvey the individual to determine the exact location of the contamination and document it on the Contaminated Personnel or Personal Effects Report (Attachment 1).

5.1.3 If the contamination is spotty, the HPT shall attempt to decontaminate the individual using swabs or soap and water. If the decontamination is successful, document the results on Attachment 1.

a. If contamination is determined to be in an individual's eyes, the eyes may be flushed using an eye wash station.

b. If contamination remains in the eyes after flushing or is determined to be in an individual's nose or ears, decontamination will be performed under the direction of the Health Physics Supervisor or qualified medical personnel.

c. Cleansing methods for skin decontamination, in order of harshness are as follows:
   1. Lifting off with sticky tape
   2. Flushing with water
   3. Soap and cool water
   4. Mild abrasive soap, soft brush, and water
   5. Detergent (soap powder)
   6. Mixture 50% powdered detergent and 50% cornmeal

5.1.4 If the contamination cannot be easily removed or the contamination is wide spread, the HPT shall escort the individual to the decontamination facility and notify the Health Physics Supervisor and the Field Manager.

5.1.5 The contamination shall be removed by having the individual wash with soap and cool water several times, if necessary. The methods listed above may be used by the HPT.

5.1.6 If the decontamination is successful, document the results on Attachment 1.

5.1.7 If, after several attempts, the contamination is not successfully removed, notify the Health Physics Supervisor.

5.2 Tool Decontamination

5.2.1 All tools being removed from the Exclusion Zone shall be checked by the HPT.

5.2.2 Tools that are contaminated shall be decontaminated before they can be released from the Exclusion Zone.

5.2.3 Tools shall be decontaminated by the users under the direction of the HPT.

5.2.4 Tools can be decontaminated using scrub brushes and soap and water, wiping with damp rags or wipes, soaking in a decontamination solution, using abrasive materials ultrasonic cleaners, or any other method approved by the HPT.

5.2.5 All interior surfaces of the tools must be decontaminated as well prior to the tool being unconditionally released.

5.2.6 If the tool is decontaminated and released by the HPT, the survey results shall be documented on a Radiological Survey Data Sheet (SOP-345 - Attachment 1)

5.2.7 If the tool cannot be decontaminated after several tries, then the tool shall be painted or sprayed with yellow paint to indicate that the item is radioactive material and kept in the Exclusion Zone.

5.3 Equipment Decontamination

5.3.1 Heavy equipment, such as backhoes, bulldozers, trucks, cranes, shall be washed with high pressure water spray prior to being surveyed by the HPT.

5.3.2 The washing of heavy equipment shall be performed in an area designated by the HPT.

5.3.3 Once the equipment is washed, it will be surveyed by the HPT. The HPT will identify any areas on the equipment that need further decontamination and will make recommendations on how to further decontaminate.

5.3.4 All surfaces of the equipment must be decontaminated and surveyed. This includes air intakes, air filters and any internal surface that is likely to be contaminated.

5.3.5 Once the equipment has been surveyed and released by the HPT, the survey results shall be documented on a Radiological Survey Data Sheet (SOP-345 - Attachment 1).

6.0 RECORDS/REPORTS/NOTIFICATIONS

6.1 Release surveys and personnel decontaminations shall be documented on the appropriate form.

6.2 Personal contaminations shall be reported to the Health Physics Supervisor and the Site Manager.

7.0 ATTACHMENTS

7.1 Attachment 1 - Contaminated Personnel or Personal Effects Report

ATTACHMENT 1

CONTAMINATED PERSONNEL OR PERSONAL EFFECTS REPORT

DATE OF INCIDENT			TIME OF INCIDENT		
NAME			BADGE NO.		
LOCATION OF INCIDENT (SPECIFIC AREA)					
DESCRIPTION	DESCRIBE IN DETAIL ANATOMICAL LOCATION, CONTAMINANT, TYPE OF INJURY, OR CONTAMINATED ARTICLE				
CONTAMINATED ARTICLE OR AREA	DECONTAMINATION AGENT USED	INSTRUMENT	SURVEY RESULTS		FINAL DISPOSITION OF ARTICLES
			BEFORE	AFTER	
WOUND COUNT /5 MIN		BKGD COUNT /5 MIN		SOURCE COUNT /5 MIN	
SAFETY MEASURES	PERTINENT SAFETY MEASURES IN EFFECT ☐ YES ☐ NO		IF NO, EXPLAIN		
REMARKS					
EMPLOYEE SIGNATURE			HEALTH PHYSICS SIGNATURE		

510 NORTH PESHTIGO COURT
CHICAGO, ILLINOIS

STANDARD OPERATING PROCEDURE

Title: Sample Preparation Procedure for Gamma Spectral Analysis

Document: SOP-364

Revision Number: 1

Date: December 16, 2015 Replaces: October 5, 2015

SAMPLE PREPARATION PROCEDURE FOR NUTRANL ANALYSIS

1.0 SCOPE

1.1 Purpose

The purpose of this procedure is to provide guidance for the preparation of samples for analysis of radioactive nuclides. This procedure applies specifically to samples prepared for NUTRANL analysis.

1.2 Applicability

This procedure applies to all soil-type environmental samples, including fill, soil, rocks, concrete, and construction debris.

2.0 REFERENCES

2.1 10 Code of Federal Regulations (CFR) Part 20 Standards for Protection against Radiation

3.0 DEFINITIONS

None

4.0 REQUIREMENTS

4.1 Prerequisites

NONE

4.2 Tools, Materials, Equipment

4.2.1 The following equipment is needed to perform this procedure:

- 20 milliliter (ml) sample vials
- Sieve of one-quarter inch mesh
- Analytical balance
- Marinelli beakers
- Zip-lock bags
- Labels
- Paper towels

4.3 Precautions, Limits

4.3.1 Samples prepared for receipt at laboratory for NUTRANL analysis are homogenized during sample collection prior to receipt at the laboratory for analysis. No other physical preparation is performed at the laboratory for screening samples (NUTRANL analysis). Any corrections or analysis other than NUTRANL pulse height analysis shall be performed by an outside contract laboratory. This includes United States Environmental Protection Agency (USEPA) verification samples and quality control (QC) samples.

4.3.2 All samples not known to be homogenous must be homogenized prior to analysis.

4.3.3 NUTRANL analysis is designed and calibrated for analysis of low activity samples, specifically for documenting closure at less than the specified removal action level. High activity samples may produce anomalous results due to algorithms in the NUTRANL programming.

4.4 Acceptance Criteria

Proper preparation during sample collection ensures that the samples submitted to the laboratory are representative of the material sampled and suitable for the required analysis. Acceptable samples will be homogeneous with regard to size of material; appearance with regard to color, moisture and soil type; shall not contain materials over the specified maximum gradation; and shall be free of external adhering soil or other materials.

5.0 PROCEDURE

5.1 All Samples

5.1.1 The following information shall be recorded and shall be taken directly from the chain of custody form, or a copy of the chain of custody form must be filed in the project folder.

- Description or grid location
- Purpose of sample which may include:
  - Activity screening
  - Pre-verification
  - Verification
  - Overburden
  - Imported fill
  - Calibration quality control check
- Date and time of sampling
- Originator of sample
- Corresponding count rate from survey meter (optional)

5.1.2 Ensure that outside of sample container is free from potential contamination by wiping it clean with a paper towel.

5.1.3 Place blank label on outside of container, and record the sample ID, which is a unique sequential number used to identify individual samples.

5.1.4 Weigh the sample on the analytical balance. Subtract the empty (tare) weight which is recorded on the side of each vial and record the net weight in grams on the label.

5.1.5 Prepare the sample in accordance with the requirements of the analysis requested.

5.1.6 Samples will have already been homogenized and passed through a ¼ inch mesh during sampling. It should not be necessary for any samples to be re-opened in the laboratory. This will eliminate the potential for the laboratory area to become cross-contaminated. This will also allow for ingrowth. Note will be made on the sample label each time the vial is opened.

5.1.7 Verification samples are handled and prepared in the same manner as others; however, they come in batches of five 20 ml vials. When samples are to be picked up by the USEPA, place each batch of five sub-samples in its own zip-lock bag.

5.2 Quality Control Samples

5.2.1 QC Samples shall be placed into 500 ml Marinelli beakers prior to analysis.

5.2.2 The technician obtaining the sample shall obtain a split sample into a 20 ml sample vial from the Marinelli beaker. This split is performed in the exclusion zone prior to submitting the sample for analysis. The split sample shall be labeled with the same description as the QC sample. The split sample shall be homogeneous with regard to the remainder of the QC sample.

5.2.3 The net weight of the Marinelli beaker shall be noted on the sample label attached to the beaker. The net weight is obtained by subtracting the weight of the beaker (tare) from the total weight of the filled beaker. The tare (empty) weight of the Marinelli beaker is recorded on the outside of each beaker.

5.2.4 The outside laboratory performing analysis of the QC sample shall be responsible for all additional sample preparation and requested analyses. This includes moisture correction and/or daughter nuclide ingrowth analysis.

5.2.5 Analyze the split sample (20 ml vial) using the NUTRANL System, and retain records for future comparison to gamma spectroscopy results.

6.0 RECORDS/REPORTS/NOTIFICATIONS

6.1 Notify the laboratory technician when the samples are properly labeled and ready for analysis.

6.2 Samples shall be retained until all evaluations have been completed and the sample is no longer needed. Samples will not be discarded until written notice is received from USEPA. Samples may be transferred to a secure holding area off-site.

6.3 Retain a paper copy of all sample analysis reports

7.0 ATTACHMENTS

None

510 NORTH PESHTIGO COURT
CHICAGO, ILLINOIS

STANDARD OPERATING PROCEDURE

Title: Operation of the AccuSpec Gamma Counter

Document: SOP-366

Revision Number: 0

Date: October 5, 2015 Replaces: New

OPERATION OF THE ACCUSPEC GAMMA COUNTER

1.0 SCOPE

1.1 Purpose

This procedure describes the step for performing gamma spectral analysis of samples utilizing the AccuSpec Gamma Spectroscopy system.

1.2 Applicability

This procedure applies to the analysis of samples utilizing the AccuSpec Gamma Spectroscopy system.

2.0 REFERENCES

- 32 Illinois Administrative Code, Parts 310 and 340, Standards for Protection from Radiation
- 32 Illinois Administrative Code, Part 400, Notices Instructions and Reports to Workers; Inspections
- AccuSpec Installation and Uses Guide, CANBERRA Program Documentation Version 03 March 1990
- RADIOACTIVE DECAY DATA TABLES, D. C. Kocher
- NaI(T1) DETECTORS MODEL 802 SERIES, CANBERRA Operator's Manual
- PHOTOMULTIPLIER TUBE BASE/PREAMPLIFIER MODEL 2007P CANBERRA Operator's Manual
- United States Nuclear Regulatory Commission (USNRC) Regulatory Guide 4.14

3.0 DEFINITIONS

None.

4.0 REQUIREMENTS

4.1 Prerequisites

4.1.1 The AccuSpec system is operational

4.1.2 Samples to be analyzed by the AccuSpec system must be in the 20 milliliter (ml) liquid scintillation vial geometry.

4.2 Tools, Material, Equipment

4.2.1 Canberra NaI(T1) detector model 802

4.2.2 Canberra photomultiplier tube base/preamplifier model 2007P

4.2.3 AccuSpec Gamma Spectroscopy program

4.3 Precautions, Limits

4.3.1 Use only plastic liquid scintallation vials 16.7 to 28 millimeters (mm) in diameter.

4.3.2 Power is to remain applied to this equipment. Should power be lost a warm up time of 24 hours may be required upon restart.

4.3.3 Ensure all samples to be analyzed are free from external contamination.

4.4 Acceptance Criteria

4.4.1 Background and Efficiency checks shall be performed daily prior to use.

NUTRANL gamma pulse height analysis software does not employ "target energies" to identify and quantify nuclides. All gamma photopeaks over the range of interest are used. The Packard AccuSpec Gamma Counter system is adjusted to monitor the energy range from 50 to 2,000 kiloelectron volts (keV), inclusive.

The Minimum Detectable Activity (MDA) is as follows:

Counting Time	U-238 pCi/g	Ra-226 pCi/g	Ra-228 pCi/g	K-40 pCi/g
	4.6	1.4	1.3	32

MDA elated in compliance with USNRC Regulatory Guide 4.14 (at 4.65 times the standard deviation of the analysis for the instrument background).

4.4.2 All efficiency checks shall be within 2 standard deviations from the certified activity of the standard measured.

4.4.3 All samples to be analyzed shall be preceded by analysis of the Uranium, Thorium, Radium, Potassium, and Blank standards.

The calibration standards contain U-238 (in secular equilibrium through U-234), Th-232 (in secular equilibrium with progeny), Ra-226 (in secular equilibrium through Po-214), picoCuries per gram (pCi/g) K-40. The density of each standard is similar to that of lightly compacted soil (1.5 g/cc). The U-238, Th-232 and Ra-226 standards are traceable to NIST. The K-40 standard is not NIST traceable. The blank is chromatographic grade alumina.

4.4.4 The Canberra system measures and records elapsed time, live time and dead time. The NUTRANL code uses the live time. System dead time is typically 9 to 0% for samples ranging from background up to 1,000 pCi/g Ra.

5.0 PROCEDURE

5.1 Initial Instrumentation Setup

5.1.1 Connect the equipment cables in accordance with the manufactures technical manual.

5.1.2 From the C:> prompt type "START" and press enter to start NUTRANL.

5.1.3 Enter "SETUP" for the category.

5.1.4 Enter."YYMMDDS1" for the sample ID.

5.1.5 Enter "SYSTEM SETUP" for the description.

5.1.6 Press the "ESC" key.

5.1.7 Open the detector shield assembly, place the 20 gram Thorium Standard in the detector, and close the detector shield assembly.

5.1.8 Select "S" to open the SETUP menu.

5.1.9 Select "V" to open the HVPS menu.

5.1.10 Select "L" to open the VOLTAGE LEVEL menu.

5.1.11 Enter "1000" to set the high voltage to 1000 volts.

5.1.12 Select "N" to turn the high voltage on.

5.1.13 Press the "ESC" key to return to the SETUP menu.

5.1.14 Select "A" to open the ADC menu.

5.1.15 Select "G" to open the CONV.GAIN menu.

5.1.16 Select "2" to set the conv. gain to 2048.

5.1.17 Press "ESC" key to return to the ADC menu.

5.1.18 Select "U" to set the ULD, normally set to 100%.

5.1.19 Set the ULD level using the left and right arrow keys, and press "ENTER" to lock the setting.

5.1.20 Press "ESC" to return to the ADC menu.

5.1.21 Set the desired LLD level using the COARSE LLD and the FINE LLD menus.

5.1.22 Press "SHIFT-F2" to erase the current spectrum.

5.1.23 Press "F1" to start acquisition.

5.1.24 Collect a spectrum that will determine the channel location of the 74 KeV peak from Thorium.

5.1.25 Adjust the ADC ZERO to place the 74 KeV peak in channel 74.

5.1.26 Repeat steps 5.1.23 to 5.1.25 to adjust the ADC ZERO.

5.1.27 Open the detector shield assembly, remove the Thorium standard, place a Cs-137 source in the detector, and close the detector shield assembly.

5.1.28 Press "SHIFT-F2" to erase the current spectrum.

5.1.29 Press "F1" to start acquisition.

5.1.30 Collect a spectrum that will determine the channel location of the 662 KeV peak from Cs-137.

5.1.31 Adjust the AMP GAIN to place the 662 KeV peak in channel 662.

5.1.32 Repeat steps 5.1.27 to 5.1.30 to adjust the AMP GAIN

5.1.33 Repeat steps 5.1.23 to 5.1.30 to until both the 74 KeV and the 662 KeV peaks are in the proper channels.

5.1.34 Record the ADC, AMP, and HVPS settings in the AccuSpec Log Book.

5.2 NUTRANL CALIBRATION

5.2.1 From the C:> prompt type "START", and press enter to start NUTRANL.

5.2.2 Enter "CALIB URANIUM" for the Category.

5.2.3 Enter "YYMMDDC1" for the sample ID.

5.2.4 Enter "URANIUM STANDARD" for the description.

5.2.5 Enter 20.0 for the weight of the sample.

5.2.6 Press the "ESC" key.

5.2.7 Open the shield assembly, place a Cs-137 source in the detector, and close the shield assembly.

52.8 Press "SHIFT-F2" to erase the current spectrum.

5.2.9 Press "F1" to start acquisition.

5.2.10 Collect at least a two minute spectrum, and press "F1" to stop acquisition.

5.2.11 Record the ADC, AMP, and HVPS settings in the AccuSpec Log Book.

5.2.12 Adjust the AMP gain settings, if necessary, to align the Cs-137 662 KeV peak in the 662 channel, and record any changes in the AccuSpec Log Book.

5.2.13 Open the detector shield assembly, remove the Cs-137 source, and place the 20 gram Uranium standard in the detector well and close the detector shield assembly.

5.2.14 Select "A" to open the acquire menu.

5.2.15 Select "P" to open the preset time menu.

5.2.16 Select "L" to open the preset live time menu.

5.2.17 Enter 16 minutes and 40 seconds, (1000 seconds) for the preset live time.

5.2.18 Press the "ESC" key until the main menu is reached.

5.2.19 Press "SHIFT-F2" to erase the current spectrum.

5.2.20 Press "F1" to start acquisition.

5.2.21 Upon completion of acquisition, press "M" to open the move menu.

5.2.22 Select "D" to open the data menu.

5.2.23 Press "ENTER" to use the default file to transfer the spectrum form.

5.2.24 Enter "F" to name the file to transfer the spectrum and press "enter".

5.2.25 Press "ENTER" to use the default Header.

5.2.26 Press "ENTER" to use the default Eff File.

5.2.27 Press the "ESC" key to return to the main menu.

5.2.28 Press "E" to exit the program.

5.2.29 Enter a "Y" to continue exiting.

5.2.30 When prompted to continue analysis enter a "Y" to perform NUTRANL analysis. The U-238 standard should yield approximately 127,200 counts in 1,000 seconds of live time counting. The counter is being calibrated against all photopeaks in the spectrum over the energy range from approximately 50 to 2,000 keV.

5.2.31 The computer will display "U-238 IS DONE. PLEASE START THE TH-232 STANDARD. PRESS ANY KEY"

5.2.32 Press "ENTER" to continue.

5.2.33 Enter "YYMMDDC2" for the sample ID.

5.2.34 Enter "CALIB THORIUM" for the category.

5.2.35 Enter "THORIUM STANDARD" for the description.

5.2.36 Press the "ESC" key.

5.2.37 Open the detector shield assembly, place the 20 gram Thorium standard in the detector well, and close the detector shield assembly.

5.2.38 Repeat steps 5.2.19 to 5.2.30. The Th-232 standard should yield approximately 1,070,600 counts in 1,000 seconds of live time counting. The counter is being calibrated against all photopeaks in the spectrum over the energy range from approximately 50 to 2,000 keV.

5.2.39 The computer will display "TH-232 IS DONE. PLEASE START THE RA-226 STANDARD. PRESS ANY KEY".

5.2.40 Press "ENTER" to continue.

5.2.41 Enter "YYMMDDC3" for the sample ID.

5.2.42 Enter "CALIB RADIUM " for the category.

5.2.43 Enter "RADIUM STANDARD" for the description.

5.2.44 Press the "ESC" key.

5.2.45 Open the detector shield assembly, place the 20 gram Radium standard in the detector well, and close the detector shield assembly.

5.2.46 Repeat steps 5.2.19 to 5.2.30. The Ra-226 standard should yield approximately 1,073,800 counts in 1,000 seconds of live time counting. The counter is being calibrated against all photopeaks in the spectrum over the energy range from approximately 50 to 2,000 keV.

5.2.47 The computer will display "RA-226 IS DONE. PLEASE START THE K-40 STANDARD. PRESS ANY KEY".

5.2.48 Press "ENTER" to continue.

5.2.49 Enter "YYMMDDC4" for the sample ID.

5.2.50 Enter "CALIB K-40" for the category.

5.2.51 Enter "POTASSIUM STANDARD" for the description.

5.2.52 Press the "ESC" key.

5.2.53 Open the detector shield assembly, place the 20 gram Potassium standard in the detector well, and close the detector shield assembly.

5.2.54 Repeat steps 5.2.19 to 5.2.30. The K-40 standard should yield approximately 14,521 counts in 1,000 seconds of live time counting. The counter is being calibrated against all photopeaks in the spectrum over the energy range from approximately 50 to 2,000 keV.

5.2.55 The computer will display "K-40 IS DONE. PLEASE START THE BACKGROUND STANDARD. PRESS ANY KEY".

5.2.56 Press "ENTER" to continue.

5.2.57 Enter "YYMMDC5" for the sample ID.

5.2.58 Enter "CALIB BACKGROUND" for the category.

5.2.59 Enter "BLANK STANDARD" for the description.

5.2.60 Press the "ESC" key.

5.2.61 Open the detector shield assembly, place the 20 gram Blank standard in the detector well, and close the detector shield assembly.

5.2.62 Repeat steps 5.2.19 to 5.2.30.

5.2.63 The computer will display "IS A NEW CALIBRATION DESIRED? "Y OR N".

5.2.64 Enter "Y" to install the calibration data into the data file.

5.2.65 The computer will display "CALIBRATION IS FINISHED. PRESS ANY KEY".

5.2.66 Press "ENTER" to continue.

5.2.67 Record the data and time of the calibration in the AccuSpec Log Book.

5.3 Daily Background and Efficiency Checks

5.3.1 From the C:> prompt type "START" to start NUTRANL.

5.3.2 Press "ESC".

5.3.3 To Perform the Background Check:

A) Press "A" to open the Acquire Menu.
B) Press "P" to open the Preset Menu.
C) Press "L" to open the Live Time Menu.
D) Enter 3600 to set the live time to 1 hour (3600 seconds).
E) Press "ESC" until main menu is reached.
F) Place an empty vial in the detector assembly.
G) Press "SHIFT-F2" to erase current spectrum.
H) Press "F1" to start acquisition.
I) Upon completion of acquisition, press "Pg Dn" until the marker/RDI Screen is Displayed.
J) Press "HOME" to set the curser at channel # 1.
K) Press "CTRL-L" to set the left marker at channel # 1.
L) Press "END" to set the cursor at channel #2045.
M) Press "CTRL-R" to set the right marker at channel #2048.
N) Copy the total CTS displayed onto the "Lab Instrument Check Sheet".

5.3.4 To perform the Efficiency Check:

A) Press "A" to open the Acquire Menu.
B) Press "P" to open the Preset Menu.
C) Press "L" to open the Live Time Menu.
D) Enter 60 to set the live time to 1 minute (60 seconds).
E) Open the shield assembly and place the check source in the detector, and close the shield assembly.
F) Press "SHIFT-F2" to erase the current spectrum.
G) Press "F1" to start acquisition.
H) Upon Completion of Acquisition, press "Pg Dn" until the markers/RDI Screen is displayed.
I) Using the arrow keys place the curser at the left start channel of the 88 Kev Peak, and press "CRTL-L" to place the left marker.
J) Using the arrow keys place the curser at the right end channel of the 88 Kev Peak, and press "CTR-R" to place the right marker.
K) Copy the net CTS displayed onto the "Lab Instrument Check Sheet".

5.3.5 Forward the "Lab Instrument Check Sheet" for input into the computer.

5.3.6 The computer tracks the background and efficiency check using a 30 day average and will report when either is outside of ±2 standard deviation.

5.3.7 If the background and efficiency check meet the acceptance criteria, place the instrument in service.

5.3.8 If the efficiency check fails to meet the acceptance criteria, then, repeat step 5.3.4.

5.3.9 If the AccuSpec fails a second efficiency check, place the instrument out of service, and notify the Lab Supervisor.

5.3.10 If the data from the Blank Standard indicates a contaminated detector, place the instrument out of service, and notify the Lab Supervisor.

5.4 Routine Sample Analysis

5.4.1 At the C:> prompt type "START" and press "ENTER" to start NUTRANL.

5:4.2 If the sources, U-238, Th-232, RA-226, K-40, and the blank, have been run for the day you may skip to step 5.4.54.

5.4.3 Enter " Source Count" for the category.

5.4.4 Enter "YYMMDXX" for the identification tag where YY = year, MM = month, DD = day.

5.4.5 Enter "Radium STD" for the description.

5.4.6 Enter "20" for the weight.

5.4.7 Enter "y" for the dry weight.

5.4.8 Press "ESC" to go to the MCA Screen.

5.4.9 Press "A" to open the Acquire Menu.

5.4.10 Press "P" to open the preset menu.

5.4.11 Press "L" to open the Live Time menu.

5.4.12 Press the "300" to set live time to 5 minutes (300 seconds).

5.4.13 Press "ESC" until the main menu is displayed.

5.4.14 Open the shield assembly, insert the EPA tailing or NBL-75 standard, and close the shield assembly.

5.4.15 Press "SHIFT-F2" to erase the current spectrum.

5.4.16 Press "F1" to start Acquisition.

5.4.17 Upon completion of Acquisition, press "M" to select transfer data.

5.4.18 Press "D" to select data.

5.4.19 Press "ENTER" to select the default file to move data from the default file.

5.4.20 Enter "F" to select the destination file.

5.4.21 Enter an "ENTER" to select the default header file.

5.4.22 Press "ENTER" to select the default efficiency file.

5.4.23 Press "ESC" to return to the main menu.

5.4.24 Press "E" to exit.

5.4.25 Enter "Y" to confirm the exit.

5.4.26 At the "Continue with Analysis (Y or N)" prompt enter "y" to perform NUTRANL Analysis.

5.4.27 Upon Completion of the analysis, enter "CTRL-E" to exit.

5.4.28 Type "PRINTOUT" and press "ENTER" to print the result.

5.4.29 Collect the printout and review the RA-226 result.

5.4.30 For the USEPA tailing standard, if the value is 309.6 pCi/g to 378.4 pCi/g, (±10% of 344 pCi/g) the result is acceptable. For the NBL-75 standard, if the value is 149.4 pCi/g to 182.6 pCi/g, (±10% of 166 pCi/g) the result is acceptable.

5.4.31 Type "START" and press "ENTER" to enter NUTRANL.

5.4.32 If the RA-226 result was not acceptable:

A) Press "ESC" to go to the MCA Screen.
B) Press "S" to open the Setup Menu.
C) Press "P" to open the AMP Menu.
D) Press "G" to open the Gain Menu.
E) Enter the Gain value determined from the Radium Analysis.

NOTE: Log the "As Found" ADC an AMP Settings in the "AccuSpec Log Book prior to adjust the gain.

F) Press "ESC" to return to the main menu.
G) Repeat steps 5.4.15 to 5.4.30.
H) Continue step 5.4.31 until RA-226 analysis is acceptable.
I) If unable to adjust gain to bring the RA-226 Value into the specifications of step 5.4-30, notify the lab supervisor, and place the AccuSpec out of service.

5.4.33 If the RA-226 result is acceptable, enter "Thorium STD" for the Description.

5.4.34 Press "ESC" to go to the MCA Screen.

5.4.35 Open the shield assembly, place the EPA Dilute Monazite or DH-1 STD in the Detector, and close the shield assembly.

5.4.36 Repeat steps 5.4.15 to 5.4.28.

5.4.37 Collect the printout and review the Th-232 result.

5.4.38 For the EPA Dilute Monazite standard, if the value is 135 pCi/g to 165 pCi/g, (±10% of 150 pCi/g), the result is acceptable. For the DH-1 standard, if the value is 102.6 pCi/g to 125.4 pCi/g, (±10% of 114 pCi/g) the result is acceptable.

5.4.39 Type "START" and Press "ENTER" to start NUTRANL.

5.4.40 If the Th-232 value was not acceptable:

A) Repeat Steps 5.4.32 A to 5.4.31 D.
B) Enter the gain value determined from the Th-232 analysis.
C) Continue at step 5.4.14.

5.4.41 If the Th-232 Value was acceptable, enter "URANIUM STD" for the description.

5.4.42 Press "ESC" to go to the MCA Screen.

5.4.43 Open the shield assembly, place the EPA Pitchblende or DH-1 STD in the detector and close the shield assembly.

5.4.44 Repeat steps 5.4.15 to 5.4.28.

5.4.45 Collect the printout, and review the U-238 result.

5.4.46 For the EPA Pitchblende standard, if the value is 2457 pCi/g to 3003 pCi/g, (±10% of 2730 pCi/g) the result is acceptable. For the DH-1 standard, if the value is 529.2 pCi/g to 646.8 pCi/g, (±10% of 588 pCi/g) the result is acceptable.

5.4.47 If the U-238 result is not acceptable:

A) Repeat steps 5.4.31. A to 5.4.31 D.
B) Enter the gain value determined from the U-238 analysis.
C) Continue at step 5.4.14.

5.4.48 If the U-238 result is acceptable, enter "Potassium STD" for the description.

5.4.49 Press "ESC" to go to the MCA Screen.

5.4.50 Open the shield assembly, place the Potassium STD in the detector, and close the shield assembly.

5.4.51 Repeat steps 5.4.15 to 5.4.26.

5.4.52 Enter "BLANK" for the description.

5.4.54 Press "ESC" to go to the MCA Screen.

5.4.55 Repeat steps 5.4.15 to 5.4.26.

5.4.56 Enter a description to the type of sample (i.e., Lot #x, off site soils, etc.) for the category.

5.4.57 Enter a sample description (i.e., Sample number).

5.4.58 Enter the sample weight.

5.4.59 Enter a "y" or "n" for dry weight.

5.4.60 Press "ESC" to go to the MCA Screen.

5.4.61 Repeat steps 5.4.9 to 5.4.11 to set count time.

5.4.62 Repeat steps 5.4.15 to 5.4.26.

5.4.63 Repeat steps 5.4.52 to 5.4.57 for each sample to be analysis.

5.4.64 Upon completion of sample analysis press "CTRL E" to exit.

5.4.65 Type "PRINTOUT," and press "ENTER" to printout a sample report.

5.4.66 Submit the data printout (see example in Attachment #1) to the Lab Supervisor and H. P. Supervisor for review.

6.0 RECORDS/REPORTS/NOTIFICATIONS

6.1 Records

6.1.1 AccuSpec Log Book

6.12 AccuSpec Sample Log Book

6.1.3 Data Printout

6.2 Reports

6.2.1 None

6.3 Notifications

6.3.1 None

6.4 Retention

6.4.1 All the records generated in performance of this procedure shall be retained for the duration of the project.

7.0 ATTACHMENTS

Attachment #1 Example - Analysis Results Printout

ATTACHMENT #1
(Example)

GAMMA-SPEC ANALYSIS RESULTS

Date Analyzed:06/15/95 Time Analyzed: 1:25 Category: Source Count Analyzed by _____
Sample ID: 950615XX Description: Radium Std

Activity is reported on AS RECEIVED basis

Weight grams	U-238 pCi/g	Th-232 pCi/g	Ra-226 pCi/g	K-40 pCi/g	Total Gamma * pCi/g
20.0	2.1 ± 22.2	-0.0 ± 5.8	1740.6 ± 12.9	-66.0 ± 112.2	1676.67 ± 115.2

• Sum of U-238, Th-232, Ra-226, and K-40. Negative values are not part of total gamma.

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STANDARD OPERATING PROCEDURE

Title: Operation of the Ludlum Model 2000 Alpha System

Document: SOP-372

Revision Number: 0

Date: October 5, 2015 Replaces: New

OPERATION OF THE LUDLUM MODEL 2000 ALPHA SYSTEM

1.0 SCOPE

1.1 Purpose

The Ludlum Model 2000 (LM 2000) Alpha System is utilized at the control line area or in the counting laboratory for measurement of gross alpha radioactivity of various types of samples. The system normally consists of a Ludlum Model 43-10 alpha scintillation detector coupled to an LM 2000 Scaler. This procedure describes the steps for operating the system.

1.2 Applicability

The LM 2000 system is used primarily for measuring smear samples and radon/thoron working level air samples for gross alpha radioactivity. If necessary, it may be used for the measurement of gross alpha radioactivity of air particulate and water samples in the event that the Gamma Products Model G5000 Gas Proportional Counting System is not available.

2.0 REFERENCES

32 Illinois Administrative Code (IAC), Parts 310 and 340, Standards for Protection Against Radiation

32 IAC, Part 400, Notices, Instructions and Reports to Workers; Inspections

State of Illinois Department of Nuclear Safety Radioactive Material License Number STA-583

Ludlum Technical Manual for Ludlum Model 43-10 Alpha Sample Counter.

Ludlum Technical Manual for Scaler Model LM 2000.

3.0 DEFINITIONS

None.

4.0 REQUIREMENTS

4.1 Prerequisites

None

4.2 Tools, Material, Equipment

4.2.1 Ludlum Model 43-10 Alpha Scintillation Detector

4.2.2 Ludlum Model LM 2000 Scaler

4.2.3 Appropriate calibration standard which is traceable to the National Institute of Standards and Technology (NIST):

a. Eberline electroplated Pu-39 standard (serial number S-4100) or equivalent.

4.3 Precautions, Limits

4.3.1 Do not exceed 1500 volts using the H.V. ADJUST ten-turn potentiometer on the front panel of the mini scaler. Photomultiplier (PM) tube damage may result.

4.3.2 Considerable time may be lost waiting for the PM tube and crystal to dark adapt. Always keep the sample drawer in the closed position when not in use to avoid possible contamination.

4.3.3 Operate the LM 2000 only in the LINE Mode as indicated on the operating knob on the front panel. Batteries are not normally installed in the LM 2000.

4.3.4 Before counting any samples, ensure that the daily background and daily efficiency determinations have been performed.

4.3.3 Any adjustments to the high voltage, window threshold, window setting, scaler or detector change out requires a recalibration of the instrument.

4.3.4 In the event of a power failure, a background check and efficiency check is required prior to placing the instrument back in service.

4.4 Acceptance Criteria

4.4.1 The daily background determination passes if the number of counts lies between the ± 2 standard deviation range established by the background control chart.

4.4.2 The daily efficiency determination passes if the number of counts lies between the ± 2 standard deviation range established by the instrument control chart.

5.0 PROCEDURE

5.1 Initial Setup

5.1.1 Apply power to the instrument by turning the operating knob located on the front panel of the scaler to the LINE position.

5.1.2 With the sample drawer in the closed position, ensure that the high voltage is adjusted to the value determined by the most recent plateau curves. If necessary, adjust the high voltage using the H.V. ADJUST ten-turn potentiometer on the front panel of the scaler.

5.2 Plateau Curves

5.2.1 High voltage source and background plateau curves must be generated initially. If, for any reason, the counting instrument, detector assembly, or PM tube is changed, a set of new curves must be run.

5.2.2 On a VOLTAGE PLATEAU form (Attachment 2), record the instrument, observer, date, time, source serial number, and any other pertinent information.

5.2.3 Turn the high voltage to a minimum using the H.V. ADJUST ten-turn potentiometer on the front panel of the scaler.

5.2.4 Apply power to the instrument by turning the power knob located on the front panel of the scaler to the LINE position.

5.2.5 Set an appropriate count time (1 minute suggested) using the timer adjustment switches on the front panel of the scaler.

5.2.6 Place the Pu-239 check source in the sample tray and close the tray by locking it closed with the unlocking knob.

5.2.7 Adjust the ten-turn potentiometer in definitive increments (50 volts suggested); recording the counts and voltage on the "VOLTAGE PLATEAU" form.

> NOTE:
> Do not exceed 1500 volts. If 1500 volts are exceeded, the photomultiplier tube may be damaged. If using the RD-14, do not exceed 1800 volts.

5.2.8 Plot the reading versus high voltage settings on a sheet of rectangular coordinate paper.

5.2.9 Remove the check source from the detector, and close the sample drawer.

5.2.10 Repeat steps 5.2.7 and 5.2.8 without the source, for a background.

5.2.11 Plot the results of the high voltage background plateau curve on the same plot as the high voltage source plateau curve.

5.2.12 From the graph, choose the high voltage setting which is located on the flat portion of the curve with a minimum background count. Set the high voltage to this value.

5.3 Chi-square Test

5.3.1 A Chi-square test must be generated upon initial setup, equipment change out or repair, high voltage adjustment, and monthly.

5.3.2 Obtain the "COUNTER TEST-CHI-SQUARED" data sheet (Attachment 1).

5.3.3 Record:

a. Your name
b. The date
c. Time
d. The high voltage setting
e. The source used

5.3.4 Open the sample tray, place the Pu-239 source into the planchet, and close the sample tray.

5.3.5 Set the timer for 1 minute, and depress the count button.

5.3.6 Upon completion of the count, record the results on the "COUNTER TEST-CHI-SQUARED DATA SHEET" (Attachment 1).

5.3.7 Repeat steps 5.3.5 to 5.3.6 until 21 data points have been recorded. Remove the source from the detector. Record this data on Attachment 1.

5.3.8 When all the above data has been entered on Attachment 1, perform the calculations on Attachment 1.

5.3.9 Using the table on Attachment 1, find the value of "P" and record the value on Attachment 1. If the value of "P" falls between 0.98 and 0.10, the counter passes the test. If the value of "P" falls outside of these values, the counter fails the test.

5.3.10 If the counter fails the test, rerun the test. If the counter fails a second time, tag the detector out of service, and notify the lab supervisor.

5.4 Background Determination

5.4.1 Perform a 50 minute instrument background check daily.

a. Verify that the LM 2000 is not in a count sequence by insuring that the "count" light is not lit.

b. Open the sample tray by operating the unlocking knob and sliding the tray out of the detector.

NOTE
The 43-10 is a scintillation detector and is light sensitive. Care must be used not to force or pull sideways when opening the sample tray.

c. Remove any sample that may have been left in the detector, and clean the sample tray with a clean cloth.

d. Insert the Pu-239 alpha standard, and shut the sample tray by gently sliding the tray into the detector and operating the unlocking knob.

e. Press the count button, and verify that the count light is on, indicating that the LM 2000 is in a counting sequence.

f. Counting is complete when the count light is extinguished.

5.4.2 Record the results of the background measurement onto the LM 2000 log and the daily LAB INSTRUMENT CHECK SHEET.

5.4.3 If the 2 sigma error from the daily background does not overlap the 2 sigma error of the previous 30 days background, then the sample tray should be decontaminated and the background should be recounted.

5.5 Efficiency Determination

5.5.1 Following the background measurement, perform an efficiency determination with the Pu-239 alpha standard designated for this purpose using a count time of 5 minutes. The efficiency determination must be performed daily, or if not used daily, prior to each use.

a. Verify that the LM 2000 is not in a count sequence by insuring that the "count" light is not lit.

b. Open the sample tray by operating the unlocking knob and sliding the tray out of the detector.

NOTE
The 43-10 is a scintillation detector and is light sensitive. Care must be used not to force or pull sideways when opening the sample tray.

c. Remove any sample that may have been left in the detector.

d. Shut the sample tray by gently sliding the tray into the detector and operating the unlocking knob.

e. Press the count button, and verify that the count light is on, indicating that the LM 2000 is in a count sequence.

f. Counting is complete when the count light is extinguished.

5.5.2 Log the results of the efficiency determination onto the daily LAB INSTRUMENT CHECK SHEET.

5.5.3 The daily efficiency determination is acceptable if the number of counts lies between the ± 2 stand deviation range established by the instrument control chart.

5.5.4 If the instrument fails the daily efficiency determination the first time, it must subsequently pass two consecutive times before the instrument is considered acceptable for operation.

5.5.5 If the daily efficiency fails two consecutive times, the instrument is placed out of operation until the cause of the failures is investigated. The system is placed back into operation only after:

a. The cause of the failures has been identified and recorded in the instrument log, and

b. Efficiencies have been verified or system recalibration has taken place.

5.6 Lower Limit of Detection (LLD) Determination

5.6.1 Use the equation shown on Attachment 3, the Smear Counting Data sheet, to determine the LLD.

5.6.2 Record the LLD on each SMEAR COUNTING DATA SHEET, or printout when available.

5.7 Routine Sample Analysis

5.7.1 Set the desired count time using the timer adjustment switches on the front panel of the mini scaler.

5.7.2 Using forceps, remove the smear or air particulate sample to be counted from the glassine envelope and load it into a sample planchet. For evaporated samples (i.e., liquids) proceed to the next step.

5.7.3 Open the sample drawer.

5.7.4 Position the sample planchet in the center of the sample drawer.

5.7.5 Slide the sample drawer to the fully closed position, and lock closed by operating the unlocking knob.

5.7.6 Start the count by pressing the COUNT button on the front panel of the scaler.

5.7.7 At the conclusion of the count, open the sample drawer, remove the sample planchet, and return the sample drawer to the closed position.

5.7.8 Remove the sample from the planchet, return it to the glassine envelope, and store the sample in the designated location.

5.7.9 Attach the printout, if available, to the survey; recording the survey number, instrument background, efficiency, and lower limit of detection on the `printout. If no printout is

available, record the counts accumulated on the scaler onto the SMEAR COUNTING DATA SHEET (Attachment 3).

5.8 INSTRUMENT OUT OF CALIBRATION

5.8.1 When an instrument is found to be "out of calibration" or fails a daily response check immediately, notify the HP Supervisor.

5.8.2 The HP Supervisor shall determine the last date that the instrument passed a daily source response check or the last calibration date, whichever is later.

5.8.3 Based on the last acceptable source response check or good calibration date, the HP Supervisor shall determine what radiological surveys were performed with the defective instrument.

5.8.4 The HP Supervisor shall determine whether regulatory or general information surveys were performed with the defective instrument.

5.8.5 Using previous surveys or previous knowledge of the survey data, the HP Supervisor shall determine whether the surveys taken with the defective meter are acceptable or whether the surveys must be re-performed. In the case of regulatory surveys, the survey shall be retaken, if possible. If resurveying is not possible, the HP Supervisor will make a written assessment of the quality of the data.

5.8.6 Source check failures/ "out of calibration" are to be recorded in the instrument log book and a nonconformance report (NCR) shall be initiated per QPM-DOC #9, in order to assess trends.

6.0 RECORDS/REPORTS/NOTIFICATIONS

6.1 Lab Instrument Check Sheet

6.1.1 The LAB INSTRUMENT CHECK SHEET is utilized to record the results of the daily background measurement and daily efficiency determination. The information from the sheet is entered into the Health Physics database.

6.2 Voltage Plateau Form

6.2.1 The VOLTAGE PLATEAU form is utilized to record the data used to generate the high voltage and background plateau curves.

6.3 Smear Counting Data Sheet

6.3.1 The Smear Counting Data sheet is utilized to record all pertinent data from smear counting where no printing device is available.

7.0 ATTACHMENTS

7.1 Attachment 1 Counter Test-Chi Squared
7.2 Attachment 2 Voltage Plateau Form
7.3 Attachment 3 Smear Counting Data Sheet

ATTACHMENT 1
COUNTER TEST - CHI -SQUARED (X^2)

OBSERVER	DATE	TIME	VOLTAGE SETTING	STANDARD
COUNT TIME - ONE MINUTE				

COUNT	NET COUNT	AVERAGE		
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
TOTAL OF 20			TOTAL	

P	X^2
0.98	8.5
0.95	10.1
0.90	11.6
0.80	13.7
0.50	18.4
0.20	23.8
0.10	27.3

IF P FALLS BETWEEN 0.98 AND 0.10 THE COUNTER IS FUNCTIONING PROPERLY

* Discard one unusually high or low count in calculating ñ.

‡ ñ $\frac{\sum n}{20} \bullet \frac{}{20} =$ _____ Enter this value in n column for each count number.

$X^2 = \frac{\sum (n - \tilde{n})2}{\tilde{n}} =$ _____ . P = _____ .

Standard Deviation for a 95% Confidence Level = (1.96) $\left(\sqrt{\frac{\sum (n - \tilde{n})2}{20}}\right)$

ATTACHMENT 2
VOLTAGE PLATEAU FORM
RD-14/LM-2000

Instrument Serial Number _____ Source Serial Number _____ Date_____
Pulser Serial Number _____ Scaler Model Number_____ Serial Number _____
Technician Name _____ Technician Signature_____

Counts per Minute

4500												
4000												
3500												
3000												
2500												
2000												
1500												
1000												
500												
0												
	700	800	900	1000	1100	1250	1300	1400	1500	1600	1700	1800

DETECTOR VOLTAGE

ATTACHMENT 3

SMEAR COUNTING DATA SHEET

TO BE USED WHEN NO PRINTOUT IS AVAILABLE

Instrument Number _____ Background _____
Efficiency_____ LLD _____ Date _____
Survey Performed By _____ Survey Number_____

SMEAR NUMBER	GROSS COUNTS PER MINUTE	DPM/100CM^2		SMEAR NUMBER	GROSS COUNTS PER MINUTE	DPM/100CM^2

LLD Calculation:

$$\text{LLD} = \frac{2.71}{Ts} + 3.29\sqrt{\frac{Cb}{Tb}\,x\left[1+\frac{(Tb)}{Ts}\right]}$$

Where
C_B = Background counts per minute
T_S = Sample count time in minutes
T_B = Background count time in minutes

Smear Activity Calculation:

$$A = \frac{(CcT) - B}{EFF}$$

Where
C_C = Gross counts
T = Count time in minutes
B = Background counts per minute
EFF = Efficiency

APPENDIX F

Plans

Dust Control Plan
Emergency Contingency Plan
Transportation and Logistics Plan
Verification Sampling Plan

510 NORTH PESHTIGO COURT
CHICAGO, ILLINOIS

Title: Dust Control Plan

Revision Number: 1

Date: December 16, 2015

Replaces: October 5, 2015

DUST CONTROL PLAN

1.0 PURPOSE

The Dust Control Plan (Plan) describes methods AECOM and its contractors will follow to conduct operations and maintain the work area within the subject site (Site) so as to minimize the creation and dispersion of dust. This Plan also contains corrective measures that will be used in the event visual dust is created, air monitoring shows excessive particulates, or air sampling indicates limits have been exceeded.

A primary concern during the excavation activities at the Site will be the generation of radioactive particulates from excavation and earth-moving equipment. Fugitive dust generation may be caused by a range of activities including excavation, loading, and transportation of excavated fill or soil. Traffic on the Site also may cause resuspension of particulates.

Dust control measures will be used throughout the excavation and restoration activities at the site, especially during excavation, backfilling, and grading activities.

2.0 GUIDANCE

Dust control will be performed in accordance with the Removal Action Work Plan (Work Plan), the Health and Safety Plan (HASP), and the Air Monitoring Procedure Standard Operating Procedure (SOP)-212. AECOM will perform site perimeter air monitoring in accordance with the Air Monitoring Procedure SOP-212.

3.0 IMPLEMENTATION

AECOM will be responsible for implementing dust control procedures as required in this Plan, the HASP, and the Air Monitoring Procedure SOP-212. The Field Team Leader will be responsible for ensuring compliance with the dust control procedures at the excavation site.

4.0 PRODUCTS

Water will be used in connection with mechanical dust suppression. Chemical foams, such as fire fighter foam, may also be used if approved by the United States Environmental Protection Agency (USEPA). If available, water will be obtained at the Site. If water cannot be obtained at the Site, temporary sources of water can be provided for construction activities from water trucks parked adjacent to the property or from portable plastic water tanks. Small (1,800 gallon) water trucks equipped with several hundred feet of hose and a pump can be used to spray water. Also, small pumps and hoses can be used with the portable tanks to provide sufficient pressure and volume for dust control. In the event that a chemical foam is utilize a Material Safety Data Sheet (MSDS) will be forwarded to USEPA.

5.0 EXECUTION

Procedures to be followed to control dust may include traffic speed control, use of stockpiles, covering vehicles transporting borrow material and waste, and wind screens around excavation areas. These procedures will be utilized during excavation, restoration, transportation and associated materials handling activities.

5.1 Traffic Speeds

Traffic speeds will be maintained in accordance with applicable County, City, State and Federal regulations. The speed limit for traffic on the site will not be in excess of 15 miles per hour.

5.2 Use of Stockpiles

Where possible, excavated contaminated materials will be loaded into the transport containers the same day they are excavated. Any radiologically-impacted material stored on-site will be placed either in containers or in Supersacks, if there is not sufficient material to mobilize a container. Stockpiled clean material, including excavated and borrow material, will be piled to minimize dust generation. Further, slopes of stockpiled materials will be minimized in the prevailing wind direction. A 5:1 slope or flatter in the prevailing wind direction will be maintained whenever possible. Stockpiles will be constructed with their length perpendicular to the prevailing wind direction.

Stockpiled material will be covered during periods of high wind or when work on a stockpile is not actively occurring, such as the end of the work day. Stockpiles will be covered with a geomembrane cover to minimize dust generation during excavation and restoration activities. Approved geomembrane covers are Griffolyn TX 1200 manufactured by REEF Industries, Inc., and Sani-Cover SC #250 manufactured by Fluid Systems, Inc., or other equivalents.

5.3 Off-Site Transportation of Excavated Materials

Trucks used for transporting non-contaminated excavated or borrow material will be equipped with truck bed covers (tarps) to prevent the generation of dust from hauling. The tarps will be fastened down tightly to prevent materials from being blown out of the trucks. Empty trucks will also be tarped.

Roll-off containers for transporting low-level radioactive materials will be lined with plastic or suitable leakproof liner and be equipped with full covers. The covers will be securely fastened to the containers before leaving the excavation area.

Trucks and other heavy equipment will be cleaned to remove mud, fill, soil and loose dust prior to leaving an excavation area. This cleaning will include the truck tires. Dirt that is tracked onto paved streets will be swept and added to stockpiles at the excavation area.

5.4 Use of Water as a Dust Suppressant

Water will be applied during the course of excavation and restoration activities as directed by the Field Team Leader to prevent, mitigate or reduce dust resulting from excavation activities. Water will be applied when:

- wind or vehicular traffic may cause visible dust generation;
- exposed surfaces of material stockpiles are potentially dry, and wind or handling activities may cause dust generation;
- dust generation is possible during excavation activities on the site;
- hauling of excavated or borrow material may cause visible dust generation in truck beds; or
- dust generation is possible during placement of materials in stockpiles or fill areas.

A water truck or pump and storage tank assembly will apply water to the exposed ground surfaces via hoses, pumps, nozzles and other appurtenances as required. The truck or pump/tank assembly also will apply water to control dust generation from exposed surfaces of material stockpiles, excavation activities, and hauling or excavation of borrow material.

Water will be applied in sufficient quantity to prevent generation of dust, but not so as to cause the movement of water beyond site boundaries, ponding or the disruption of other project site areas. Because the fill and soil will absorb the water, watering is not expected to generate runoff. The Field Team Leader

will monitor the excavation and restoration activities to make sure that enough water is used to adequately control dust but that not too much water is used so as to create runoff.

5.5 Corrective Measures

If visual dust is created at a location during the excavation and restoration activities or if air monitoring shows excessive particulates, the following corrective measures will be evaluated and applied, as appropriate.

1. Increased wetting of surface areas.
2. Covering additional source areas.
3. Modifying future excavations and stockpiles to decrease the source areas.
4. Halting dust-creating activities until winds moderate.
5. Modify work activities.

If overwatering creates runoff into undisturbed areas, the water will be removed as practical, and the area radiologically surveyed. If radioactivity above the action level is found, the area will be cleaned by removing the contaminated materials or by other appropriate means. Future occurrences will be prevented by more carefully controlling the amount of water applied by constructing earth berms around the area to retain the water or by using a method of dust control other than water.

510 NORTH PESHTIGO COURT
CHICAGO, ILLINOIS

Title: Emergency Contingency Plan

Revision Number: 1

Date: December 16, 2015 Replaces: October 5, 2015

EMERGENCY CONTINGENCY PLAN

1.0 SCOPE OF PLAN

The purpose of the Emergency Contingency Plan (ECP) is to provide guidance and direction in the event of an unanticipated exposure of an individual to hazardous substances or hazardous conditions related to the excavation and restoration activities.

Personnel assigned to this project will be required to review thoroughly the contents of this ECP and to strictly adhere to the policies and procedures provided herein.

2.0 EMERGENCY AND EVACUATION PLAN

2.1 Emergency Coordination

The Field Team Leader will coordinate emergency response at the Site. In the event of an emergency, the Field Team Leader will immediately notify the AECOM Project Manager. The AECOM Project Manager will be responsible for notifying the proper response agencies listed in Table 1, Emergency Phone Numbers. Emergency response procedures, instructions for emergency response to injuries and evacuation plans will be reviewed at safety briefings.

2.2 Emergency Services Contacts

Before field activities commence, the Field Team Leader will inform the appropriate emergency contacts about the nature and duration of work expected at the Site and the type of contaminants and possible health or safety effects or emergencies involving these contaminants.

All hospital treatment should be provided via the 911 Emergency Medical System, with the Chicago Fire Department providing ambulance service. Emergency services can be provided by Northwestern Memorial Hospital located within one-half mile of the Site. The location and route to the hospital from the Site, including narrative directions, are shown on Figure 1.

The emergency telephone numbers listed in Table 1 will be distributed to the Field Team Leader. Emergency numbers will be reviewed every three months by the AECOM Project Manager and revised, as necessary. The AECOM Project Manager will date and sign new revisions. The Field Team Leader will record the date of the revised telephone number list in his daily log book. Upon revision, the table will be submitted to the United States Environmental Protection Agency (USEPA) and the City of Chicago.

2.3 Implementation

The Field Team Leader will implement the emergency action procedures whenever conditions at the Site warrant such action. The Field Team Leader will be responsible for coordinating the evacuation, emergency treatment and emergency transport of Site personnel, as necessary, and informing the appropriate coordinating management staff. The following conditions may require implementation of emergency action procedures:

- Fire or explosion on-site.
- Serious personal injury.
- Release of radioactivity exceeding one Annual Limit of Intake (ALI) as defined in 32 Illinois Administrative Code (IAC) 340.1220 in a 24-hour period.
- Release of hazardous materials, including gases or vapors, at elevated levels.
- Unsafe working conditions, such as inclement weather (tornado, hail, etc.).

2.4 Fire or Explosion

If fire or explosion takes place, emergency steps shall include: 1) evacuation of work area and 2) notification of local fire department and other appropriate emergency response groups listed on Table 1, as necessary (e.g., if a spill occurs, the emergency spill hotline will be notified).

2.5 Personal Injury

Actions to be taken in the event of personal injury are described in the Health and Safety Plan, Section 4.3.4, Emergency Medical Treatment.

2.6 Evacuation Plan

All project personnel will evacuate the area under the direction of the Field Team Leader. Evacuation from the affected area will be initiated by sounding an alarm, such as an air-horn, megaphone or other form of notification.

A coordinated evacuation will be conducted with all project personnel using the most direct upwind route, avoiding the point of emergency.

All project personnel involved in the evacuation will immediately move to the Decontamination/Transition area and will remain there awaiting further instructions from the Field Team Leader.

Personal Protective Equipment will be used at all times by the project personnel during the evacuation procedures.

2.7 Accident and Incident Reporting

All accidents, injuries and incidents shall be reported to the Field Team Leader. An Accident/Injury Form will be completed by the Field Team Leader, as described in the HASP, Section 4.4, Accident and Incident Reporting.

TABLE 1
EMERGENCY PHONE NUMBERS

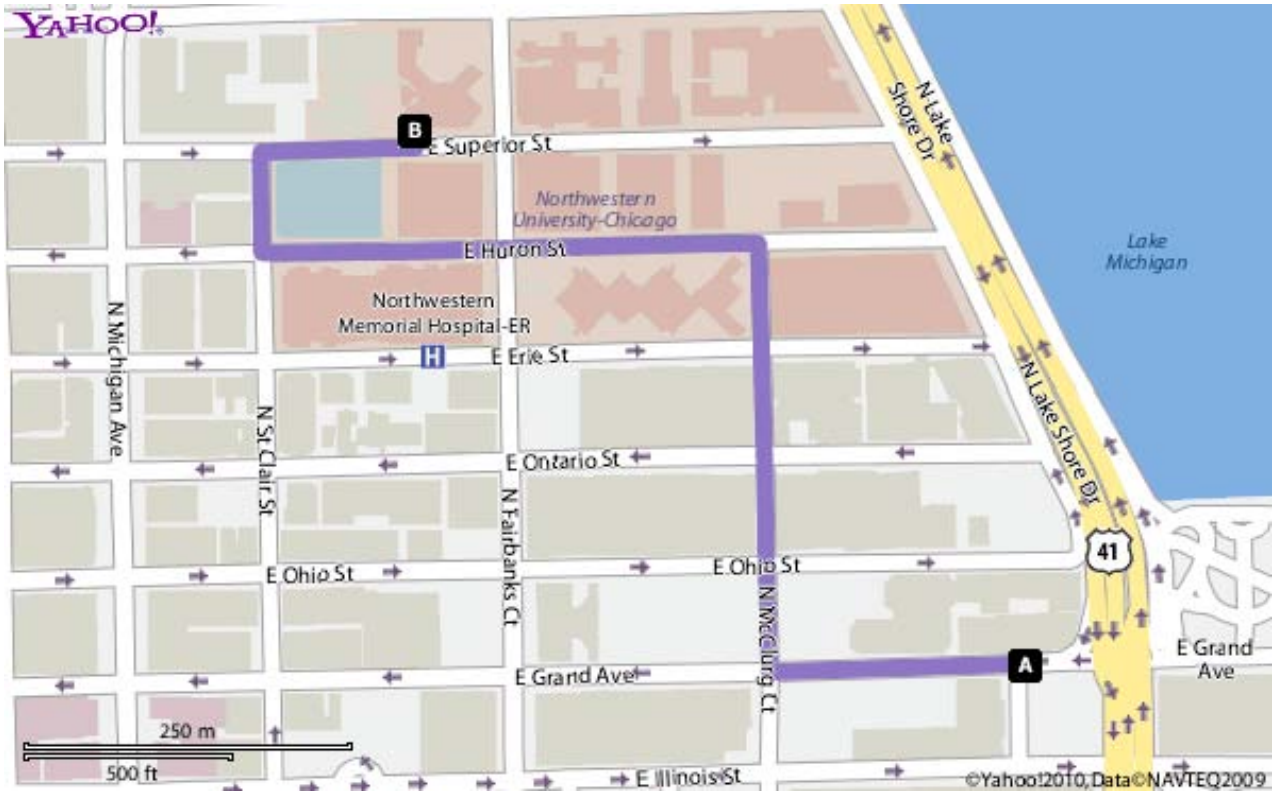
Police Department	911
Fire Department	911
Ambulance	911
Hospital Address Phone	Northwestern Memorial Hospital 250 E. Superior (312) 908-2000 (Ask for ER)
Poison Control Center	(800) 732-2200
USEPA Region 5 24-hours Emergency Number	(312) 353-2318
AECOM Project Manager Steven Kornder	262-515-7700 (mobile))
AECOM Technical Lead Steven Kornder	262-515-7700 (mobile)
AECOM Field Team Leader Andrew Kozak	847-612-9049 (mobile)

SECONDARY EMERGENCY NUMBERS

The AECOM Project Manager will evaluate when these agencies should be notified.

National Response Center Hotline	(800) 424-8802
Illinois Emergency Management Agency (IEMA) – Division of Nuclear Safety	(800) 782-7860
Illinois Environmental Protection Agency Emergency Response Duty Officer	(217) 782-3657, IEPA ERU during normal working hours.

FIGURE 1
HOSPITAL LOCATION AND DIRECTIONS
Northwestern Memorial Hospital
250 E. Superior Street
Chicago, IL 60611



Directions:

1.	**Start at 510 N PESHTIGO CT, CHICAGO going toward N MCCLURG CT**	**go 0.1 mi**
2.	**Turn Right on N MCCLURG CT**	**go 0.2 mi**
3.	**Turn Left on E HURON ST**	**go 0.3 mi**
4.	**Turn Right on N ST CLAIR ST**	**go 0.1 mi**
5.	**Turn Right on E SUPERIOR ST**	**go 0.1 mi**
4.	**Arrive at 250 E SUPERIOR ST, CHICAGO, on the left**	

510 NORTH PESHTIGO COURT
CHICAGO, ILLINOIS

STANDARD OPERATING PROCEDURE

Title: Transportation and Logistics Plan

Revision Number: 1

Date: December 16, 2015 Replaces: October 5, 2015

TRANSPORTATION AND LOGISTICS PLAN

Material exceeding 7.1 pCi/g total radium will be generally be directly loaded into containers for shipment and off-site disposal. Containerized material may be stored staged on-site until such time as adequate material is accumulated for shipment. In the event that super-sacks are used, tarps and/or plastic may be placed both beneath and above the sacks as necessary to minimize water infiltration.

At present, it is anticipated that radiologically contaminated materials encountered above the USEPA removal action level will be sent to either the US Ecology disposal facility in Grand View, Idaho or EnergySolutions located in Clive, Utah. Manifesting, shipping and placarding (if applicable) will be performed in accordance with Department of Transportation (DOT) regulations for shipping radiologically contaminated material based on the activity of the waste materials. Prior to initiating transportation, USEPA notification in writing of the shipment including: (1) the name and location of the facility to which the radiologically contaminated materials will be shipped; (2) information that notification was given to the receiving state; (3) the type and quantity of the radiologically contaminated material to be shipped; (4) the expected schedule for the shipment of the radiologically contaminated material; and (5) the method of transportation.

510 NORTH PESHTIGO COURT
CHICAGO, ILLINOIS

Title: Verification Sampling Plan

Revision Number: 1

Date: December 16, 2015

Replaces: October 5, 2015

VERIFICATION SAMPLING PLAN

1.0 INTRODUCTION

1.1 Purpose

This Verification Sampling Plan (Plan) describes the sampling activities and analytical methods that will be used to demonstrate the subject site meets the removal action level. By following the protocol included in this plan, the United States Environmental Protection Agency (USEPA) will demonstrate the Site meets the removal action level described in the work plan and associated Administrative Settlement Agreement and Order on Consent (ASAOC).

1.2 Scope

The verification survey will be conducted as excavation activities are completed at a Site. The purpose is to demonstrate that the fill or soil has been excavated to meet the removal action level described in the UAO. Averaging over areas up to 100 square meters is allowed, but only after reasonable efforts have been made to achieve levels As Low As Reasonably Achievable (ALARA). (Reference SOP-223 "Verification Survey Procedure").

1.3 Contaminants of Concern

The verification program includes testing for specific constituents which are indicative of the contaminants of concern. Constituents of concern that may be encountered on the Site are the entire U-238 and Th-232 decay series; however, measurements will only be made for total radium (Ra-226 and Ra-228).

1.4 References

The following references have been used in developing this Plan:

- 32 IAC 332.150(b) - Soil Radioactivity and Exposure Rate Criteria;
- DOE Order 5480.11 and 10 CFR 20 - Surface Contamination and Exposures (ALARA); and
- NUREG/CR 5849 "Manual for Conducting Radiological Surveys in Support of License Termination" Draft June 92.

Standard Operating Procedures (SOPs) used during the verification sampling are included in the Standard Operating Procedures.

2.0 EXCAVATION CONTROL

2.1 Gamma Survey

A gamma survey will be done after the excavation is thought to be complete. The survey will comprise verification testing of the excavation.

Gamma measurements will be made over the entirety of the excavation. The procedure and instrumentation used will be 2 x 2 NaI detectors. This procedure provides a gamma measurement survey over an area of approximately one square meter. The gamma measurements will be collected over the entire area of the excavation to determine the concentration of radium remaining.

If the gamma survey indicates areas where the measured radium concentration exceeds the removal action level of 5 picoCuries per gram (pCi/g) radium (Ra-226 and Ra-228) above background, additional

material will be removed until the measured radium concentration is less than 5 pCi/g above background. Exceptions may be made to this operational criterion with USEPA concurrence.

In addition to the gamma survey, AECOM will obtain samples for laboratory testing to measure the total radium concentration of the fill or soil. Such testing may be used to resolve ambiguous gamma survey measurements, to establish or verify gamma/radium correlations, or to provide additional data to verify that the removal action level have been met at the excavation. At least one composite sample will be taken for laboratory analysis from each excavation. The samples will be taken in accordance with the soil sampling procedure in SOP-214, and tested for radium (Ra-226 and Ra-228). Apparently clean material below the radiologically-contaminated fill may be excavated to facilitate verification. This material will require sampling as overburden if it is to be managed as uncontaminated soil for backfill.

2.1.1 Gamma Survey Procedure

The gamma survey will be performed according to the Gamma Survey Standard Operating Procedure (SOP-210).

2.1.2 Documentation

The Verification Gamma Survey drawing described above will be used to document the readings obtained during the gamma survey. The drawing also will contain information pertaining to background gamma radiation levels and instrument calibration.

2.1.3 Quality Control

The gamma survey will be performed by trained individuals who have sufficient skill to obtain accurate and consistent information. All information obtained during gamma surveys will be reviewed by the Field Team Leader for accuracy and consistency.

All field equipment will be calibrated either in accordance with NUREG/CR 5849 "Manual for Conducting Radiological Surveys in Support of License Termination" Draft June 1992 or with industry-recognized protocols. Instrument response background and check source tests will be performed and recorded daily to ensure instrument operations are within the established acceptable range.

At least 5 percent of the survey area will be resurveyed. Readings from the initial survey will be compared to those readings obtained during the quality control (QC) survey to identify instrument malfunctions or reading/document errors.

3.0 DECONTAMINATION

All discarded materials, waste materials, and other field equipment and supplies shall be handled in such a way to prevent the potential spread of contamination during excavation and restoration activities. Discarded items that have contacted contaminated materials will be containerized and stored for disposal at the approved disposal facility. Non-contaminated items to be discarded will be collected for disposal as non-hazardous waste. Personnel and sampling equipment decontamination are described in the Decontamination Procedure included as SOP 347.

APPENDIX G

Specifications

Section 01010	Summary of Work
Section 01020	Construction Health and Safety
Section 02010	Demolition and Debris Removal
Section 02200	Contaminated Material Loadout and Earthwork
Section 02840	Site Utilities

510 NORTH PESHTIGO COURT
CHICAGO, ILLINOIS

Title: Summary of Work

Section 01010

Revision Number: 1

Date: December 16, 2015 Replaces: October 5, 2015

SECTION 01010

SUMMARY OF WORK

PART 1 - GENERAL

1.1 Description of the Project

This project directed by the United States Environmental Protection Agency Region 5 (USEPA) is at a location designated by the USEPA as related to the Lindsay Light II Site in Chicago, Illinois. The work covered by these specifications includes the following.

A. Project Description

1. Work for the cleanup of the Site will be excavation and removal of contaminated fill or soil.

2. Site preparation includes all of the work which must be done before any excavation and restoration can begin. Some of the work, such as determining background air quality and background radiation, will be common to the entire Site. Other work, such as verifying the extent of contamination and documenting existing physical conditions, will be area-specific.

   a. Access Agreements. Discussions concerning access will begin promptly upon approval notice from the USEPA. Every effort will be made to keep the property owner and the USEPA informed of any changes to the work and to the schedule.

   b. Permits. Under Superfund, the Site developer is exempt from obtaining permits from the City of Chicago and Cook County for remediation removal activities conducted on-site, but must obtain permits for portions of the work accomplished off-site. Some permits, particularly those issued by the Department of Transportation to commercial carriers to transport the excavated fill, soil and debris over public streets, will not be sought and, therefore, are not addressed in this Plan. The Site developer will contract only with transportation companies qualified and licensed to carry such materials.

   c. Background Air Monitoring. Unless requested by the USEPA, monitoring and analyses will not be conducted prior to beginning excavation at the Site. A description of the air monitoring that will be done is included in the Air Monitoring Plan for the Site.

   d. Site Survey. If one is not already available, prior to work at the Site a current site survey will be prepared by a licensed surveyor.

   e. Soil Sampling. Fill or soil sampling is described in the Soil Sampling Plan (SOP-214). Background gamma values are developed in accordance with Gamma Radiological Surveys (SOP-210).

   f. Utilities. For the Site, "utilities" will include, but not be limited to, natural gas, drinking water, waste water, communications, electrical power distribution, and storm water collection systems. The locations of all utilities will be determined, field located and shown on all maps and drawings for the properties. All work to replace, repair or backfill utilities shall be done as required by the appropriate utility company or agency.

   g. Buildings. No buildings are present within the areas proposed to be excavated.

3. Excavation and restoration work includes removing any structures, facilities, landscaping or other appurtenances as necessary, excavating contaminated fill or soil, cleaning contaminated buildings, facilities, structures, utilities and appurtenances, verifying that

radioactivity greater than the removal action level has been removed and backfilling all excavations. Site restoration is not proposed pending site development and construction.

a. Work to remove asphalt pavements, sidewalks, foundations, retaining walls, etc., is described in Section 4.0 of the Work Plan

b. Work to excavate contaminated fill or soil is described in Sections 4.0 and 5.0 in the Health and Safety Plan (HASP) for the Site.

c. The requirements for fill or soil sampling are described in the Soil Sampling Plan.

d. The work for properly backfilling all excavations is included in the Work Plan.

1.2 Related Work

Other Part 1 Sections of these Specifications.

1.3 Definitions

A. Access Agreement refers to a legal document between the Contractor, Property Owner and tenant authorizing the Contractor or the USEPA to complete the excavation and restoration action as described in these Specifications, the Work Plan and the HASP.

B. City refers to the City of Chicago and its representatives.

C. Contract Documents for the work consist of the drawings, these specifications and all addenda issued prior to and all modifications issued after the execution of the contract.

D. Contractor refers to AECOM and its subcontractors and consultants.

E. County refers to Cook County, Illinois and its authorized representatives.

F. USEPA refers to the Region 5 office of the United States Environmental Protection Agency and its representatives.

G. Job Set refers to a complete set of Project Record Documents used during construction activities.

H. Project refers to all activities associated with the excavation and restoration action.

I. State refers to the State of Illinois and its authorized representatives.

J. Utilities. For the project, "utilities" will include, but not be limited to, natural gas, drinking water, waste water, communications, and electrical power distribution and storm water collection systems.

K. Work Order refers to the plans, drawings, additional specifications, directions and agreements prepared for properly completing work at the Site.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

3.1 Scope of Work

A. The work to be performed includes furnishing all labor, tools, equipment, materials, transportation, services, and incidentals, and performing all operations necessary for the excavation and transportation of radiologically-contaminated fill or soil, and the monitoring of those excavations as shown and noted on the drawings and as required in these Specifications.
B. The work includes the decontamination of the Site and the management of excavation and demolition materials in accordance with the Statement of Work. The work included is further described in Article 3.2, Construction Sequence.

3.2 Construction Sequence

Except as specifically noted, the construction sequence described below is intended as guidance for this project. At the discretion of the Contractor, the work may be done simultaneously or in an order other than below, as long as it will not affect the quality, timely completion, or safety of the work.

B. Mobilization

1. Mobilize personnel, equipment, materials, and temporary facilities needed for the project. Provide for electrical, water, communications and other utilities as required for the work.

2. Provide site-specific training for workers. Discuss work with crews, including areas of special concern (construction and radiological), construction schedule and sequence, and health and safety.

3. Prepare the personnel and equipment decontamination facilities.

4. Select areas within the Site for staging fill or soil containers and demolition materials. Prepare areas as necessary (e.g., berms for temporary water control, or plastic sheeting if on "clean" area)

5. Set up the air monitoring system and begin monitoring.

6. Set up traffic controls, as required.

C. Contamination Excavation

1. Excavation of contaminated buildings is not anticipated.

2. Excavation of contaminated fill or soil will occur using these steps:

   a. Do construction staking or marking (additional surveying, as necessary, for horizontal and vertical limits of fill or soil excavation). These limits will be based on the previous AECOM site investigation reports.

   b. As necessary, lock-out, tag-out, and/or shut down all utilities which could affect or be affected by the work. Purge, decontaminate and otherwise properly manage utilities so they can be removed, protected from damage, or relocated, as necessary.

   c. Excavate the contaminated fill or soil on the property and transport them to the disposal facility. Stockpile fill or soil on the Site only as necessary.

   d. Do fill or soil sampling and gamma surveying to determine if additional excavation is necessary. Excavation will not extend below groundwater.

(i) If necessary, do construction staking. Continue excavating until surveying and sampling indicate all contaminated materials have been removed.

(ii) Notify the USEPA that pre-verification sampling has been completed and request verification surveying and sampling, and if found to meet the closure standard, request approval to backfill.

D. Restoration

1. Restoration is not proposed for the Site. Minimal restoration may consist of flattening the slopes of the excavations. The Site will be regraded in preparation for construction and development.

3.3 Disruption

A. The contractor will, to the extent practical, use his best efforts to undertake the project in a manner that avoids unnecessary disruption of local businesses and their customers or tenants.

3.4 Work Quality Control

A. Shop and field work shall be performed by personnel thoroughly trained and experienced in their field of expertise. Work on this project shall be performed in accordance with the best practices of the various trades involved.

B. Quality control inspections will be conducted for all construction activities under these specifications. The inspector will be independent of the work activity being inspected.

C. Work will be certified as having been completed in full satisfaction of these Specifications.

D. Work will be done as required by these Specifications, the Work Plan and other documents referenced in these Specifications.

510 NORTH PESHTIGO COURT
CHICAGO, ILLINOIS

Title: Construction Health and Safety

Section 01020

Revision Number: 1

Date: December 16, 2015 Replaces: October 5, 2015

SECTION 01020

CONSTRUCTION HEALTH AND SAFETY

PART 1 - GENERAL

1.1 Scope

A formal Health and Safety Plan (HASP) has been prepared for the work described in these Specifications. This section of the Specifications summarizes the requirements of the HASP as they apply to the construction work, and references those sections of the HASP where detailed descriptions of the health and safety requirements and procedures can be found.

1.2 Related Work

A. Other Part 1Sections of the Specifications
B. Section 02010 - Demolition and Debris Removal
C. Section 02200 – Contaminated Material Loadout and Earthwork
D. Section 02840 - Site Utilities

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

3.1 Safeguards will be taken to ensure the safety of workers in and around excavations. These will include, but not be limited to, the following:

a. Stairways, ladders, ramps, or other safe means of egress will be located in trench excavations that are 4 feet or more in depth.

b. No persons will be permitted underneath loads handled by lifting or digging equipment. Personnel are required to stand away from any vehicles being loaded or unloaded to avoid being struck by any spillage or falling materials.

c. All trenches and excavations 6 inches or deeper will be marked and guarded for the duration of the project with barricades placed a minimum of 2 feet from the edge of the excavation to prevent persons from falling into the opening.

d. Precautions will be taken to prevent surface or runoff water from entering the excavation. Ditches, dikes, or other effective means will be installed or used to prevent water from entering the excavation and to drain the surrounding areas.

e. Any excavation that meets the definition of a confined space will be treated as such, as defined by OSHA 1910.146, and all applicable procedures detailed in Section 13 of the HASP will be followed. A crawl space or storm cellar area could fall within the definition of a confined space if it: (1) is large enough and so configured that personnel can bodily enter and perform assigned work; and (2) has limited or restricted means for entry or exit; and (3) is not designed for continuous personnel occupancy.

f. All personnel in an excavation greater than four feet in depth will be protected from cave-ins by an adequate protective system. An adequate protective system will include barrier protection (e.g., shoring or trench boxes) or sloping. Other protective measures required by 29 CFR 1926, Subpart P also will be provided.

g. The determination of the angle of repose and design of any supporting system will be based on careful evaluation of pertinent factors such as depth of cut; possible variation in water content of material while the excavation is open; anticipated changes in materials from exposure to air, sun, water, or freezing; loading imposed by structures, equipment, overlying material, or stored material; and vibration from equipment, blasting, traffic, or other sources.

h. Daily inspections of excavations, the adjacent areas, and protective systems will be made and documented by a competent person. The documentation will include indications of potential cave-ins, failure of protective systems, hazardous atmospheres, or other conditions.

i. No employee or any other person will work adjacent to or enter an excavation until the work area has been inspected by the competent person. The inspection will determine if conditions exist which may expose workers to moving ground or any other unsafe conditions. Any deficiencies identified during inspections will be adequately corrected prior to work in excavation.

3.2 Training

1. All persons active in the excavation work at the Site will receive training as specified in Section 5 of the HASP for work with low-level radioactive materials. The training program in Section 5 of the HASP is in accordance with 29 CFR 1910.

2. In addition to the training above, periodic "tailgate" health and safety meetings will be held. The purpose of these meetings will be to discuss deficiencies in health and safety practices, discuss hazards specific to new properties or encountered at existing properties, discuss the results of monitoring, and generally reinforce good health and safety practices. A typical form for such meetings is found in Section 5 of the HASP.

3. Special training shall be provided or required for work such as the following.

   a. Supervisory Work. All supervisors shall have received at least the additional eight hours training required by OSHA.

   b. Truck Driver. All truck drivers shall be instructed in and knowledgeable about the routes to be used between the property and the train station, the requirements of the work (work with and transport of potentially radioactive materials), and the emergency and contingency procedures to be implemented in the event of an accident.

   c. All persons employed in the transport and handling of radioactive materials shall have received HAZMAT training.

   d. A competent person will be on-site for shoring.

3.3. Personal Protective Equipment (PPE) - Based on information obtained from monitoring observation of similar work at vicinity properties, work at this Site can be done in Level D PPE. The Health and Safety Coordinator will evaluate individual tasks and work areas and specify particular types of PPE based on this evaluation. PPE utilized in the performance of the work under these specifications will be in accordance with Sections 7 and 8 of the HASP.

3.4 Hot Work

A. Flame welding and cutting operations

1. Gas bottles shall be properly color-coded, in good condition, and stored in a secured manner in racks or carts. Bottles with corroded or damaged threads will not be used.

2. Regulators shall be in good condition, and suitable for the use.

3. Fuel gas and oxygen hose shall be easily distinguishable and shall not be interchangeable. Hoses shall be inspected at the beginning of each shift and shall be repaired or replaced if defective.

3.5 Transporting Contaminated Materials Over Uncontaminated Areas

A. Offsite Transport

1. Rolloff containers used to transport contaminated materials over uncontaminated areas will be capable of transporting the material without spillage. Covers will be secured onto the containers prior to exiting the contaminated area. Empty trucks returning to the site will be tarped, as will trucks supplying clean backfill, topsoil, and related construction materials. Tarps will be fastened down tightly to prevent material from being blown out of the trucks.

3. Trucks and rolloff containers used to transport contaminated materials will be frisked and decontaminated if necessary in accordance with Subpart 3.8, below, prior to exiting the contaminated area.

4. Should a truck hauling contaminated material from the Site accidentally spill any part of its load, the Contractor will direct site workers to assist in the cleanup, if applicable. Spill cleanup, including proper notification of agencies and authorities, will be accomplished in accordance with the Emergency Contingency Plan.

B. Transport within a Property

1. Haulage routes will be established within the Site and all workers will be instructed in the location and use of these routes. Following excavation and restoration of fill, soil and other materials, such routes will be examined, visually and with radiation detection equipment, for the presence of spilled materials. All spilled materials will be removed.

2. Practices to control spillage will be implemented during excavation and restoration. These practices will include such things as the following:

a. Not filling haul equipment above the sides of the bed or bucket,

b. Limiting travel speed, and

c. Covering haul routes with clean fill or soil or other materials. Such materials would be inspected as above, and decontaminated for reuse or properly transported to the rail terminal for eventual transfer to the approved disposal facility.

3.6 Equipment Decontamination Facilities

A. Equipment Decontamination Station – If necessary, an equipment decontamination station will be made available for the decontamination of vehicles, tools, and equipment, prior to exiting the

controlled area. The equipment decontamination station will be located within the secured area, and will include the following:

1. A steam pressure washer for removing contamination from the wheels, tracks, and other surfaces of the equipment and trucks.

B. Release of Construction Vehicles and Equipment for Unrestricted Use - Prior to being released from the Exclusion Zone, all construction vehicles and equipment will be frisked, and decontaminated if necessary. Contaminated vehicles and equipment will be decontaminated using a pressurized water spray in accordance with Subpart A, above. Water generated during the decontamination activities will be evaporated, infiltrated within the Exclusion Zone, used for dust control, or collected and stored on the Site for other purposes or eventual disposal.

3.7 Dust and Water Runoff Control

A. Dust control measures used during work activities on the Site may include, but are not limited to the following:

1. Using hoses with mist or fog nozzles to spray light applications of water over the areas of excavation or demolition, staging, loadout, and dumping/storage. The Contractor will be responsible for the control of excess water.

2. Minimizing travel over fill or soil areas. Some travel over contaminated fill or soil (e.g., by excavation equipment and by haul trucks) may be necessary. Dust minimization procedures will include, but not be limited to, the following.

   a. Within the property, the speed limit for trucks and excavation equipment will be fifteen miles per hour.
   b. Areas which will be used extensively as travelways (e.g., entrances to and exits from equipment decontamination facilities) will be sprayed with water as necessary to control dust.

3. Storage and staging piles will be covered when not in use.

B. Runoff water control measures on the Site may include, but are not limited to the following:

1. Excavation of temporary swales, ditches, and/or retention ponds.

2. Construction of temporary diversion dikes and berms.

3. Pumping of water to runoff water control facilities. Water removed from contaminated excavations will be evaporated, used for dust control, or collected and stored on the Site.

3.8 Contingency Plans and Emergency Response Procedures

Contingency plans and emergency response procedures for Site activities are provided in the Emergency and Contingency Plan. These plans and procedures will be followed in the event of an emergency situation arising from the work activities or acts of God that may affect the environment or human health and safety.

510 NORTH PESHTIGO COURT
CHICAGO, ILLINOIS

Title: Demolition and Debris Removal

Section 02010

Revision Number: 1

Date: December 16, 2015 Replaces: October 5, 2015

SECTION 02010

DEMOLITION AND DEBRIS REMOVAL

1.0 GENERAL

1.1 Scope

A. This section describes general requirements for existing Site features during thorium related investigations, including:

1. Salvage Disposition, Storage, and Handling of Property.

2. Demolition of Existing Site Features.

3. Sawcutting.

4. Debris Segregation, Decontamination, Haulage, Storage, and Disposal.

5. Matching and Patch Repairing.

B. Descriptions for radiological surveying are specified in the Work Plan, Appendix F (Verification Sampling Plan)

1.2 Related Work

A. Part 1 Sections of these Specifications.

B. Section 02840 - Site Utilities

1.3 Salvage Disposition. Storage and Handling of Property

A. Remove all structures, equipment, facilities, materials and other items called for in the Work Plan or that otherwise must be removed to access the work areas and store as directed. Such items shall be removed completely, including appurtenances, and shall be properly protected.

B. All non-radiologically-contaminated materials, equipment, and other items permanently removed from the work area for the proper completion of the excavation work shall be properly managed and/or disposed as applicable.

1.4 Submittals

A. All submittals shall be made to the AECOM Project Manager.

B. Submit landfill tickets for all uncontaminated debris disposed offsite, no more than five days after disposal, except where dumpsters are emptied directly into collection trucks. The use of dumpsters will be recorded in the field logbook. Each ticket shall contain at least the information below.

1. Date of disposal.

2. Estimated volume or weight of load if required by the designated measurement method of the landfill.

3. Description of materials disposed.

4. Name of wastehauling subcontractor.

1.5 Health and Safety Conditions of the Work

In addition to the hazards common to demolition, radioactive materials are known to be present at this Site, and may be present in or on slabs/paving, structures, facilities and utilities.

A. Detailed health and safety requirements for work on the vicinity properties are included in Section 01020 of these Specifications and the HASP.

B. All demolition work will be done as required by OSHA regulations published in 29 CFR 1910 and 1926. These regulations are included by reference in these Specifications.

C. Based on existing information, excavation work can proceed under Level D personal protection conditions (see HASP). Air, fill and soil monitoring and sampling will be done during the conduct of the work to determine if modifications to Level D work conditions are necessary.

1. The Contractor shall be prepared to discontinue work in an area and begin work in an alternate area if monitoring and sampling indicate changes in the work conditions may be necessary and if so directed by the AECOM Project Manager, AECOM Field Team Leader, or their Agent.

2. The Contractor shall be prepared to begin working under changed conditions (greater than or equal to Level D personal protection with appropriate personal, equipment and vehicle decontamination) with minimal delay. Additional requirements which may be necessary if asphalt, concrete, wood, metal or other construction materials containing hazardous materials or levels of radiation above background are encountered are discussed in Section 01020 of these Specifications.

D. The Quality Assurance Supervisor, Field Team Leader, or Health and Safety Coordinator may bar from the Site any person or persons who shows a disregard for health and safety of themselves or others.

1.6 Permits

A. The Contractor shall be responsible for obtaining all permits required for the work and additions described in this section of these Specifications.

B. Copies of all the necessary permits shall be provided to the Project Quality Assurance Supervisor prior to beginning the work.

C. At a minimum, all work shall be done in accordance with the requirements of the permits. The requirements of these permits are included by reference in these Specifications. Where the requirements of the permits and these Specifications are in conflict, the more stringent requirements shall apply.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

3.1 General

A. The work performed under these Specifications shall be done as indicated in this Work Plan, specified herein, and as required by the permits and the laws, rules and regulations of the City of Chicago, the State of Illinois and the USEPA.

B. The Contractor shall remove existing property features as indicated in the Work Plan and shall perform demolition in a manner to allow segregation and proper disposal of contaminated and uncontaminated material. The Contractor must use methods and operations which will minimize the potential for the spread of contamination.

C. It shall be the Contractor's responsibility:

1. To maintain adequate safety measures and working conditions (see Section 01020 of these Specifications and the HASP).

2. To take all measures necessary during the performance of the work to protect the entire project area and adjacent properties which would be affected by this work from storm damage, flood hazard, caving of trenches and embankments, and sloughing of material, until final acceptance by the AECOM Project Manager, AECOM Field Team Leader, or their Agent.

3. To maintain completed areas until the entire project area is in satisfactory compliance with the Specifications.

3.2 Structure Demolition

A. General

No structures are present on the site, where excavation is proposed.

B. Foundations

1. The methods used to demolish and remove foundations shall be at the discretion of the Contractor, as long as the requirements of these Specifications, the permits, and the laws, rules and regulations of the City, County, State, OSHA or the USEPA, whichever are more stringent, are met.

2. All demolition of foundations shall be done in a manner to minimize disturbance of the surrounding and underlying fill or soil. This could include, but not be limited to, pre-breaking or sawing the foundation elements, and the measures described in Article 3.3 of these Specifications.

3. Concrete, rock or block foundations may be demolished and reduced in size as described in the foregoing subpart.

4. Foundation walls which serve as retaining walls to support earth or adjoining structures shall not be demolished until such earth has been properly braced, or adjoining structures have been underpinned to prevent movement. Bracing and shoring shall be evaluated and, if necessary, designed by a qualified Professional Engineer.

5. Adjacent foundation walls and "party" walls to a basement, which are to serve as retaining walls against which fill or debris will be placed, shall be checked for structural strength before they are to be so used. Evaluations and, if necessary, designs of shoring and bracing shall be done by a qualified Professional Engineer.

6. Foundations and basement floor slabs will be removed to verify conditions beneath them. The concrete, if not contaminated, will be staged on-site for later removal or will be removed as clean debris. Concrete found to be contaminated will be decontaminated in accordance with SOP-345. If decontamination cannot be reasonably completed, the concrete will be reduced in size sufficient to be managed as contaminated and loaded for off-site shipment and disposal.

C. Retaining Walls

1. The methods used to demolish and remove retaining walls shall be at the discretion of the Contractor, as long as the requirements of these Specifications, the permits, and the laws, rules and regulations of the City, County, State, OSHA or the USEPA, whichever are more stringent, are met.

2. All demolition of retaining walls shall be done in a manner to minimize disturbance of the surrounding and underlying fill or soil. This could include, but not be limited to, pre-breaking or sawing the pavement and slabs, and the measures described in Article 3.3 of these Specifications.

3. Shoring or bracing may be necessary during the demolition of retaining walls. Shoring or bracing shall be designed by a qualified Professional Engineer, competent in soils. Shoring and bracing designs shall be submitted to the Respondents or their Agent and the Field Team Leader prior to beginning excavation where their use may be necessary.

4. Concrete, rock or block foundations may be demolished and reduced in size as described in the foregoing subpart.

3.3 Sawcutting

A. The Contractor shall be responsible for all sawcutting necessary for the excavation of contamination whether described in the Work Plan or not. The Contractor shall sawcut concrete, masonry, asphalt paving, and other work as needed, observing the following requirements:

1. The Contractor shall provide liquid or other dust control for all sawcutting of contaminated materials or materials overlying contaminated materials.

2. Finished vertical concrete or masonry cuts shall be made using a track-mounted concrete saw. The finished cut shall be a minimum of three inches deep, in a straight and true line.

3. Finished horizontal concrete or masonry cuts shall be made using a cradle-mounted concrete saw. Make the finished cut a minimum of three inches deep, in a straight and true line.

4. Where portions of masonry will be removed and replaced, masonry excavation and restoration shall be along mortar joints so the finished wall will have the same masonry pattern as the existing.

5. Finished asphalt paving cuts shall be made using an asphalt blade in a cradle-mounted saw. The finished cut shall be a minimum of two inches deep, in a straight and true line.

6. If a clean break cannot be made where new concrete will be replaced against old concrete, provide sawcutting necessary to produce clean edges on the existing concrete.

3.4 Decontamination of Items

A. Some contaminated items such as slabs, pavement, and piping, can be decontaminated and disposed in industrial or other landfills. Decontamination of items will include removing the contaminated dust, dirt or encrustations from the surfaces of the items. Decontamination may be accomplished by high-pressure spraying, or manually removing contaminated materials with brushes, soap and water, rags, and miscellaneous hand tools until the items are verified as radiologically suitable for the proposed disposal.

B. Decontamination of contaminated equipment, tools, materials and supplies is described in detail in SOP-347 Decontamination.

3.5 Contaminated Material Loadout and Transport

A. General Requirements

1. Before beginning contaminated material loadout operations, the Contractor shall construct temporary site drainage facilities, and if necessary, initiate dust control measures. The Contractor also shall construct all decontamination and loadout facilities and establish survey controls.

2. The Contractor shall use equipment and methods that minimize the potential for spillage of materials during loading operations.

3. At a minimum, the loadout shall be cleaned (liquid and nonliquid wastes removed) at the end of every other day. Spilled materials shall be promptly removed from the loading facility if the quantity is such that the material could be picked up and transported out of the loadout facility.

4. All decontamination of equipment shall be done as required herein and by SOP-347 Decontamination.

5. In no case shall equipment with radioactivity above the release levels be allowed to leave the Site.

B. Loadout

1. All loadout of material will be done as required by these Specifications and the Work Plan. Loading of trucks and other containers with contaminated fill, soil or debris shall be done only in the loadout or equipment decontamination areas.

2. Contaminated fill, soil and debris will be loaded directly into containers as they are excavated, and the container staged in a clean area for pickup and transport. Materials will be placed so they do not extend above the sides of the container. Materials protruding above the sides of the container will be pushed down or removed for placement into another container. If isolated quantities of contaminated fill or soil are encountered in volumes less than necessary to fill a container, the material will be placed in Supersacks and stored temporarily until there is sufficient material accumulated to fill a container.

3. Rolloff containers will be secured with lids.

4. Drivers shall remain inside the truck with the windows closed or shall exit the truck prior to loading.

C. Decontamination

1. Detailed requirements for the decontamination of trucks and containers are provided in SOP-347 Decontamination.

2. Following loading in the loadout area, and decontamination if such is necessary, all trucks and containers will be frisked.

3. If frisking shows such is necessary, trucks and containers will be decontaminated by wiping or spraying.

4. Trucks and containers need a final survey prior to unrestricted release from the loadout.

D. Transport

1. Trucks picking up and dropping off containers at the staging areas outside of the loadout need not be decontaminated unless a container spill has occurred.

2. Trucks shall only use the designated route(s) to transport materials from the Site, and shall obey all signs, speed limits and other traffic laws. Any driver not obeying traffic laws, or the requirements of these Specifications, shall be removed from the work.

3. All trucks shall properly display decal with all information required for transport of contaminated materials.

4. Each truck shall carry the standard industry bill of lading for each shipment.

5. All truck drivers shall have the training required by 29 CFR 1910.120 and shall be trained in the procedures to be used in the event of an emergency, as described in the Emergency Contingency Plan.

3.6 Storage

A. All storage or stockpiling of materials shall be done as required by Section 02200 of these Specifications and described in the Work Plan.

B. On the Subject Site

1. Non-radioactive materials, including fill, may be temporarily stockpiled (staged) on the Site in the locations noted in the Work Plan, or as approved or directed by AECOM or its Agent.

   a. As necessary, staged non-radioactive materials shall be covered or otherwise managed to control dust.

2. Radioactive materials may be staged on the Site only with written approval from the USEPA and approval by the AECOM Project Manager.

   a. Radioactive materials shall only be stored on contaminated or specially prepared areas to minimize the potential for contamination of "clean" areas.

   b. All excavated radioactive materials shall be containerized by the end of the day. If isolated quantities of contaminated fill or soil are encountered in volumes less than necessary to fill a container, the material will be placed in Supersacks and stored temporarily until there is sufficient material accumulated to fill a container.

c. Except when work is actively in progress, the staged contaminated materials that are not containerized shall be stored temporarily in Supersacks on-site. Radiologically-impacted material that cannot be placed in containers for overnight storage will not be excavated.

C. On the Rail Terminal Site

1. If radiologically-contaminated materials will be transported by rail for disposal, the loaded and tarped containers will be stored at the rail terminal temporarily until the appropriate train is loaded and dispatched to the permanent disposal facility.

3.7 Disposal

A. At a minimum, all materials shall be disposed as required by the permits, these Specifications, and the laws, rules and regulations of the State of Illinois or the USEPA, whichever are more stringent. All materials to be disposed shall be surveyed as required by SOP-345 to determine they are suitable for the intended disposal method and location.

B. If clean materials are disposed by landfilling or recycling, the Contractor shall provide the AECOM Project Manager and the Field Team Leader with the name of the landfill or recycler.

1. The landfill or recycler must be qualified to receive the waste. The landfill or recycler must provide the Contractor with qualification information.

2. The AECOM Project Manager or its Agent has the right to reject any landfill which does not meet qualification standards.

3.8 Cleanup

Upon completion of work in this section, all rubbish and debris shall be removed from the job site. Soil or fill materials that were excavated from the site and were determined not to exceed the removal action level of 7.1 pCi/g total radium (Ra-226 + Ra-228) may be used or redeposited on the site as fill material. All construction equipment and implements of service shall be removed and the entire area involved shall be left in a neat, clean and acceptable condition.

510 NORTH PESHTIGO COURT
CHICAGO, ILLINOIS

Title: Contaminated Material Loadout and Earthwork

Section 02200

Revision Number: 1

Date: December 16, 2015 Replaces: October 5, 2015

SECTION 02200

CONTAMINATED MATERIAL LOADOUT AND EARTHWORK

PART 1 - GENERAL

1.1 Scope

A. General

1. Descriptions of the landscaping, structures, etc. for the Site are included in the Work Plan of which these Specifications are a part.

1.2 Related Work

A. Part 1 Sections of these Specifications

B. Section 02010 - Demolition and Debris Removal

D. Section 02840 - Site Utilities

1.3 Site Investigation

A. Investigation Reports

Investigation reports included in the Appendices may be used as a guide to conditions on this project as they contain boring summaries and related information depicting surface and subsurface conditions at specific locations at the Site. Surface and soil conditions at other locations may differ from conditions occurring at the boring locations. Therefore, further investigations will be done prior to and during the excavation activities.

B. Contractor's/Subcontractor's Responsibility

The Contractor/Subcontractor shall carefully examine the Site and make all inspections necessary in order to determine the full extent of the work. The Contractor/Subcontractor shall satisfy himself as to the nature, location and conditions of the work, the conformation and condition of the existing ground surface, and the character of equipment and facilities needed prior to and during prosecution of the work. The Contractor/Subcontractor shall satisfy himself as to the character, quality, and quantity of surface and subsurface materials or obstacles to be encountered. Any inaccuracies or discrepancies between the actual field conditions and the Work Plan, or between the Work Plan and Specifications, must be brought to the attention of the Project Coordinator in order to clarify the exact nature of the work to be performed.

1.4 Health and Safety

A. Detailed discussions of the potential hazards and the requirements for minimizing the potential for harm to project and offsite personnel, and to the environment, are provided in Section 01020 and Section 1.5 of this section of these Specifications.

B. All work shall be done under the supervision of personnel experienced and qualified for the work.

C. All work will be done as required by OSHA regulations published in 29 CFR 1910 and 1926. These regulations are included by reference in these Specifications.

D. Based on preliminary results, sampling and analyses of fill or soil from the Site indicate levels of radioactivity above background levels. Based on the sampling and surveys, the work can proceed under Level D personal protection conditions. Air and soil monitoring and sampling will be done during the conduct of the work to determine if modifications to Level D work conditions are necessary (see Sections 01020 and 02010 of these Specifications). A complete description of health and safety requirements for this site is provided in the Health and Safety Plan (HASP) for this project.

1. The Contractor shall be prepared to discontinue work in an area and begin work in an alternate area if monitoring and sampling indicate changes in the work conditions may be necessary and if so directed by the Respondents or his Agent.

2. The Contractor shall be prepared to begin working under changed conditions (greater than or equal to Level D personal protection with appropriate personal, equipment and vehicle decontamination) with minimal delay. The requirements which may be necessary if asphalt, concrete, wood, metal or other construction materials containing levels of radiation above background encountered are discussed in Section 02010 of these Specifications.

E. The Field Team Leader or Health and Safety Coordinator may bar any person from the site who, in their opinion, shows a disregard for health and safety requirements.

1.5 Environmental Safeguards and Regulations

A. The Contractor shall comply with all federal, State, and local regulations, and the requirements of these Specifications at all times to prevent pollution of air, water and soil.

B. The Contractor will preserve and protect all structures, equipment, and vegetation (such as trees, shrubs and grass) on or adjacent to the work area, which is not to be removed and which does not unreasonably interfere with the excavation or restoration work. The Contractor will only remove trees when such is required by the Work Plan and will avoid damaging vegetation that will remain in place. Limbs or branches of trees broken by the contractor will be trimmed with a clean cut, and the cut painted with a tree-pruning compound.

C. The Contractor will control air and water pollution as described in these Specifications and the Work Plan.

1.6 Permits

A. The Contractor shall be responsible for obtaining all permits required for the work and additions described in this section of these Specifications.

B. Copies of all the necessary permits shall be provided to the Project Quality Assurance Manager prior to beginning the work.

C. At a minimum, all work shall be done in accordance with the requirements of the permits. The requirements of these permits are included by reference in these Specifications. Where the requirements of the permits and these Specifications are in conflict, the more stringent requirements shall apply.

1.7 Submittals

A. All submittals shall be made to the Respondents or their Agent, with copies submitted to the Field Team Leader.

B. The Contractor shall maintain a log of those submittals directed by the Respondents.

C. Import Backfill Materials

1. The Contractor will submit a list showing materials expected to be imported, and the name(s) and locations of the supplier(s) of each type of material.

2. Submit analyses such as radioactivity, geotechnical, gradation, and proctor test results of backfill materials, and certification of conformance with material specifications as determined by the testing consultant for each material, in accordance with testing per Section 2.E of this specification.

3. The above information shall be submitted with the Work Plan for the Site for each source, prior to use.

D. Imported Backfill Material Truck Tickets

1. Submit imported backfill material truck tickets no less than five days prior to submittal of application for payment of the applicable items of work. Minimum required information on truck tickets includes the following.

   a. Date of delivery.
   b. Material description.
   c. Truck identification number or license number.
   d. Gross weight and tare weight or volume of load.
   e. Supplier name/source.
   f. Signatures of scale operator and truck driver.

2. Truck tickets without the above information will not be accepted for payment.

E. Soil Compaction Test Report

1. Submit soil compaction test reports indicating test results from the testing consultant. The Contractor shall be prepared to provide preliminary test results within 24 hours of the test. Final test results shall be submitted to the Contractor and available for review within seven days of testing.

2. Test results shall include time and date of test, test methodology, location of test, name of person and firm conducting the testing, and any pertinent information which may affect the test results.

1.8 Definitions

A. Excavation. Excavation is defined as reaching the lines, grades, elevations and contamination depths shown in the Work Plan or determined by in-place monitoring. Excavation of uncontaminated topsoil, silt, clay, sand, gravel, talus, soft or disintegrated rock, boulder or detached pieces of soil, rock or debris shall be included, as well as excavation of contaminated material. During the excavation work, monitoring of radiological contamination of the excavated material will be done by the Respondents.

B. Contaminated Fill or Soil

1. Fill or soil which must be excavated, transported, or disposed under special conditions. Fill or soil from these sites may have levels of radioactivity above background. Determining the

vertical and horizontal extent of contaminated fill or soil will be the responsibility of the Respondents.

2. Fill or soil containing concentrations of Ra-226 plus Ra-228 greater than five picoCuries per gram (5 pCi/g) of dry fill or soil above natural background averaged over six-inch thick layer are considered radioactively contaminated.

C. Salvaged Excavation Materials Uncontaminated fill or soil materials from designated areas of the Site suitable for use as common or structural fill which are not otherwise classified as unsatisfactory (see Part 2 of this Section). Unless otherwise directed by the Work Plan or the Respondents' Agent, salvaged excavation materials shall be used to backfill designated onsite excavations a minimum of six inches below finished grade.

D. Overexcavation. Excavation of any type of material in excess of the lines, grades or depths indicated in the Work Plan or beyond the limits defined by the Work Plan or Specifications.

E. Unsatisfactory Fill Materials Unsatisfactory materials for fill include, but are not limited to, materials containing organic matter, trash, debris, frozen materials, materials containing radioactivity or other hazardous contaminants in excess of regulatory standards, and materials not meeting the criteria of Part 2 of this section. Materials which are unsuitable due to excessive or insufficient moisture or gradation may be used if they can be brought into compliance with the requirements of Part 2 of this section by screening, manipulation, aerating, watering, or blending with other suitable materials. Unsatisfactory fill materials shall not be used.

F. Percent Maximum Density. Percent maximum density is a percentage of the maximum density at optimum moisture obtained by the appropriate test procedure.

G. Stockpile Construction. Stockpile construction is defined as construction of a stabilized fill which will serve as a temporary storage stockpile constructed of contaminated or uncontaminated materials.

H. Subgrade Preparation Subgrade preparation includes fine grading, scarification and compaction, of existing ground, upon which additional materials will be placed.

1.9 Applicable Publications.

The publications listed below form a part of these Specifications to the extent referenced. The publications are referred to in the text by the basic designations below.

1. American Society for Testing and Materials standard methods of testing. Hereinafter designated as ASTM. The letters and numbers following ASTM (e.g., D698) refer to a particular test.

2. Standard Specifications for Road and Bridge Construction, Illinois Department of Transportation. Hereinafter referred to as State Specifications.

3. Standard Specifications for Water and Sewer Main Construction in Illinois, Fourth Edition.

4. City of Chicago Zoning Ordinances.

1.10 Quality Assurance

A. The Respondents shall make available soil-testing services, either through its own forces or through a soils-testing consultant. The Respondents shall be responsible for taking fill or soil samples and performing moisture-density, gradation, and other tests to ascertain the completed

work is in compliance with these Specifications. Samples may be taken at the place of excavation, stockpiles, or from the fill itself. The Respondents shall conduct density and other tests on the fill as required by these Specifications. The Contractor shall assist the Respondents as necessary to enable sampling and testing.

B. The Field Team Leader shall be a person qualified and experienced in the work described in these Specifications.

C. By Contractor/Subcontractors

1. All work shall be done under the supervision and control of experienced and qualified personnel, competent in the areas of expertise required for the work described in these Specifications and other documents.

2. The Contractor, at his discretion, may have such tests and inspections as he may desire performed by other qualified personnel or independent testing services, for his guidance and control of the work. The cost for such tests and inspections shall be borne by the Contractor. The Quality Assurance Supervisor will consider the results of such testing in determining whether work has been properly done, but the approval of work shall be made by the Respondents or their Agent.

D. Applicable Criteria. Tests and Standards

1. For Excavation of Radioactive Fill or Soil. Detailed descriptions of the testing methods and equipment for radioactive fill or soil are described in the Verification Sampling Plan. All fill or soil containing concentrations of Ra-226 plus Ra-228 greater than five pCi/g of dry soil above background, averaged over a six inch layer, shall be removed.

2. For Disposal of Radioactive Fill or soil. All contaminated fill or soil will be disposed in the manner approved by the USEPA. At present, this is to transport the material to a facility licensed to accept these materials for disposal.

3. For Site Earthwork

   a. Except for grading and fill under pavement, slabs or structures, surfaces shall be excavated, or filled or graded to plus or minus 0.2 feet (±0.2') of line, slope and elevation shown in the Work Plan, provided in these Specifications, or as directed by the Project Coordinator or Field Team Leader.
   b. Areas under pavement, slab or structures shall be filled and/or graded to t0.1 feet.
   c. The Contractor will provide survey control for establishing and maintaining excavation and fill. Cut and fill stakes will be placed as necessary, but at least on 50-foot centers, to control excavation and fill. All surveys required to meet City of Chicago earthwork permit requirements shall be performed by a licensed land surveyor. Other surveying will be done by an experienced line and grade surveyor.
   d. Following completion of the work, the Site shall be surveyed to confirm all regrading and reconstruction work has been done to proper line and grade.

4. Compaction

   a. Compaction of backfilled common materials shall be to at least 90 percent of maximum density (standard proctor - ASTM D698) for areas not covered by structures, paving or slabs, to at least 95% of maximum density for areas to be covered by paving or slabs, and to at least 95% for areas under structures and utilities.
   b. Compaction of backfilled select or structural materials shall be to at least 92% of maximum density (standard proctor - ASTM D698) for areas not covered by structures,

paving or slabs, to at least 95% of maximum density for areas to be covered by paving or slabs, and to at least 95% for areas under structures and utilities.

c. Maximum densities and optimum moisture information can be obtained from borrow area operators; if this information is not available, the Contractor shall obtain samples representative of all soil to be used for common backfill and provide them to the Respondents or their Agent for testing. Test samples will be provided before backfilling begins.

5. Compaction Testing shall be done on at least 50-foot centers or at least once per lift. Compaction will be tested and determined by competent personnel using methods such as nuclear density gauges (if proper calibration can be achieved), sand cones, or other methods. Compaction work shall be sufficiently observed and all areas of a lift shall be visually inspected by the Respondents or their Agent and the Field Team Leader so they can state their opinion that areas not tested for compaction have been compacted as tested areas.

6. Soil testing. All testing (gradations, liquid limits, etc.) will be done using American Society for Testing and Materials (ASTM) procedures and methods.

7. Cleanup. The Contractor shall remove all rubbish, debris, junk, temporary materials, and any surplus excavated materials from the Site, as directed by the Respondents or their Agent. Excavation and proper disposal of these materials and the restoration of staging and storage areas and temporary roads to the satisfaction of the Respondents or their Agent shall be a condition for final acceptance.

PART 2 - PRODUCTS

2.1 Backfill Materials

A. General - Fill materials shall be obtained from suitable stockpiles or borrow as defined in these Specifications. Materials containing organic (except topsoil), perishable, spongy, frozen, expansive or other deleterious materials shall not be acceptable.

B. Materials for Common Fill shall consist of any material imported or excavated from the cut or other borrow sources that, in the opinion of the Respondents or their Agent, are suitable for use in constructing fills. The material shall contain no rocks or hard lumps greater than four (4) inches in size and shall contain at least 40 percent of material smaller than 1/4-inch sieve opening in size. No material of a perishable, spongy, or otherwise improper nature shall be used in filling.

C. Imported Fill

1. Roadbase materials shall conform to State Specifications Section 704.

2. Crushed Rock or Stone for use as fill shall conform to State Specifications Section 704.01.

3. Fine Aggregate or Sand shall conform to State Specifications Section 703.04.

4. Structural Fill under building slabs, ramps, and stairs shall conform to State Specifications Section 704.04, CA-6 or CA-10.

5. Selected Granular Backfill shall conform to Section 20-2.21 C of the Standard Specifications for Water and Sewer Main Construction in Illinois, FA-1 or FA-2.

D. Material placed within 24 inches of rough grade shall be select material that contains no rocks or hard lumps greater than four (4) inches in size and that swells less than 3% when compacted as hereinafter specified for compacted fill.

E. Soil testing

1. Prior to use, all off-site fill or soil sources shall be tested as follows:

   a. Radioactivity Material must be tested for radioactivity and found to be within background ranges (3.7 pCi/g as established by the USEPA in Tech Memo date March 15, 1995).
   b. Engineering Classification ASTM D2487
   c. Standard Proctor Compaction ASTM D698

2. Provide one series of tests for each 10,000 cubic yards of borrow soil used. At least one series of tests will be obtained from each borrow source to be used.

3. Testing of potential on-site fill or soil backfill is described in the Field Sampling Plan.

PART 3 - EXECUTION

3.1 General

A. The work performed under these Specifications shall be constructed to the lines, grades, elevations, slopes and cross-sections indicated in the Work Plan, specified herein, and/or directed by the Respondents or their Agent. Slopes, graded surfaces, and drainage features shall present a neat uniform appearance upon completion of the work.

B. It shall be the Contractor's responsibility:

1. To maintain adequate safety measures and working conditions.

2. To take all measures necessary during the performance of the work to protect the entire project area and adjacent properties which would be affected by this work from storm damage, flood hazard, caving of trenches and embankments, and sloughing of material, until final acceptance by the Respondents or their Agent.

3. To maintain completed areas until the entire project area is in satisfactory compliance with the Specifications.

C. Utility lines and structures indicated in the Work Plan which are to remain in service shall be protected by the Contractor from any damage as a result of his operations.

1. Where utility lines or structures not shown in the Work Plan are encountered, the Contractor shall report them to the Respondents or their Agent before proceeding with the work.

2. Unless their excavation is necessary to allow work to proceed or as a result of contamination, the Contractor shall bear the cost of repair or replacement of any marked utility lines or structures which are broken or damaged by his operations.

3. All repair work, including backfilling, shall be done as required by the governing utility or agency. The Contractor shall contact the governing utility or agency and determine the requirements for properly completing the work. A description of the requirements may be requested to be provided to the Respondents and the Field Team Leader before any work is done.

3.2 Excavation and Restorations. Clearing and Grubbing

A. Clearing. Clearing consists of the complete excavation of objectionable materials and obstructions above and below the ground surface, including tree stumps, brush, grass, vegetative matter and other objectionable materials within the project limits. All brush and organic material shall be removed before placing any earth fill unless the earth fill to be placed is topsoil.

B. Grubbing, Grubbing consists of the complete excavation of stumps, including tap roots or lateral roots 1-1/2 inches or more in diameter, and the excavation of brush, grass or weeds to depths below the natural ground as specified herein. Stumps shall be grubbed to a depth of 3 feet and grass or weed shall be grubbed to a depth of 12 inches below the natural ground surface, or to the depths as determined in the field by the Respondents or their Agent at the time of construction.

C. Protection. Existing items not designated to be demolished or removed shall be protected from damage. Any such item damaged by the Contractor shall be restored or replaced immediately at the Contractor's expense.

D. Debris and Surplus Material. All debris and surplus material resulting from clearing, and grubbing shall be removed from the site and properly managed by the Contractor. The requirements for managing concrete and asphalt materials are described in Section 02010 of these Specifications.

3.3 Dust Control

The Contractor shall take all steps practical to control dust arising from the construction activity. Detailed discussions of the requirements and potential methods for controlling dust are described in Appendix A of the Work Plan.

3.4 Control of Drainage Water

A. The Contractor shall control drainage water in the area of construction operations, and control storm water and wastewater reaching the construction area from any source, so that no damage will be done to the work or to the environment. The Contractor shall be responsible for any damages to persons or property on or off the construction site due to such drainage water or to the interruption or diversion of such storm water or wastewater on account of his operations.

B. Surface grading shall be done as may be necessary to prevent surface water from flowing into excavations.

1. Any water accumulating therein shall be removed by pumping or by other approved methods.

2. Any water accumulating in a work area which may be contaminated will be tested prior to disposal. If contaminated, such water will be disposed as directed by the Respondents or their Agent.

3. Any water which is the result of the Contractor's failure to properly control drainage will be removed and disposed at the Contractor's expense.

3.5 Excavation

A. General

1. The locations of surveyed benchmarks and estimated depths of cut for beginning the work are shown in the Work Plan. The Contractor shall be responsible for providing additional staking and surveying, including both horizontal and vertical controls, to ensure the Work is

done to the standards of these Specifications. The Project Coordinator and Field Team Leader will be available to assist and advise the Contractor.

2. The Contractor shall perform all excavation necessary or required as shown in the Work Plan, or required by these Specifications or the Respondents or their Agent. The excavation shall include the disposal or stockpiling of all materials of whatever nature encountered, which shall include both contaminated fill or soil excavation and common soil excavation when both are present, and shall include the furnishing, placing, and maintaining of shoring and bracing necessary to safely support the sides of the excavations.

3. If the horizontal and vertical limits of excavation, as determined by radiological testing, are less than shown in the Work Plan, the Contractor shall excavate only those materials necessary to achieve compliance with the standards of these Specifications.

4. If the horizontal and vertical limits of excavation, as determined by radiological testing are greater than shown in the Work Plan, the Contractor shall extend the limits of excavation as necessary to achieve compliance with the standards of these Specifications.

5. Excavated material shall be placed a sufficient distance from the edge of the excavation to avoid cave-ins or bank slides. In no case shall excavated materials be placed closer than three feet to the edge of the excavation.

6. Shoring and bracing, if necessary, shall be designed by a qualified Professional Engineer competent in fill or soil engineering.

7. The work also shall include all pumping, ditching and other required measures for the removal or exclusion of water.

B. Contaminated Fill or soil

1. Interpretation of the Work Plan

   a. The Work Plan indicates the estimated horizontal and vertical extent of a contaminated deposit.
   b. Depths of contaminated and uncontaminated fill or soil indicated in the Work Plan represent the total estimated depth from the ground surface to the base of the contamination. The different depths shown across a given deposit are an indication of how the actual contamination depths might be expected to change throughout a given deposit.
   c. Information in the Work Plan indicates the existing surface cover material. Unless otherwise indicated, the replacement surface cover shall match existing.
   d. All contaminated materials, including clay, silt, sand, gravel, cobbles and boulders, and rock will be excavated. The Contractor shall be prepared to conduct whatever excavation is necessary to remove contaminated materials.

2. Excavation Procedures

   a. If possible, contaminated material shall be removed from outlying areas and boundaries of contaminated areas, working toward the equipment decontamination and loadout facilities, to minimize the potential to contaminate "clean" areas.
   b. Truck or container loading shall be done only on ground contaminated and designated for cleanup or on the equipment decontamination pad or other area specially prepared for such work. Care should be taken to avoid spilling during loading.

c. Contaminated (see Subpart 1.8, B, Definitions of this section) and uncontaminated fill and soil shall be separated during excavation and kept separate during loading, transport and stockpiling to minimize the potential for cross-contamination.

d. Excavations shall be performed carefully to minimize the potential for mixing with underlying fill or soil. Also, cleated or crawler-type equipment shall not be allowed without prior approval of the Respondents or their Agent.
e. Excavations will be radiologically monitored and surveyed by the radiologic technicians to determine if additional material must be removed. Detailed descriptions of the radiological monitoring requirements during excavation are provided in applicable SOPs.
f. The Contractor shall excavate contaminated and uncontaminated fill or soil to within three inches of the design or estimated depth. From this point, excavation should proceed in no greater than six-inch lifts to the depths indicated in the Work Plan. After excavation of each lift, the Respondents will radiologically monitor the excavation and delineate additional excavation required (see the Field Sampling Plan).
g. Exceptions to these requirements must be approved in writing by the Respondents or their Agent and provided to the Field Team Leader. The Contractor will not be paid for removing extra quantities resulting from a deviation from the above requirements, unless a specific deviation has received prior written approval.

D. Other

Uncontaminated material, including clay, silt, sand, gravel, cobbles and boulders and rock, may need to be removed for slopes on excavations, to expose contaminated fill or soil, structures or facilities, or to facilitate work to remove contaminated fill or soil, structures or facilities. Common materials removed from such areas may be used for backfill if they meet the requirements for fill material. If unsuitable, they shall be removed, transported and disposed as surplus excavation.

3.6 Contaminated Material Loadout and Transport

A. General Requirements

1. Before beginning contaminated material loadout operations, the Contractor shall construct temporary site drainage facilities and initiate dust control measures. The Contractor also shall construct all decontamination and loadout facilities and establish survey controls.

2. The Contractor shall use equipment and methods that minimize the potential for spillage of materials during loading operations.

3. At a minimum, the truck loadout shall be cleaned (liquid and nonliquid wastes removed) at the end of every day. Spilled materials shall be promptly removed from the loading facility if the quantity is such that the material will be picked up and transported out of the loadout facility (e.g., dirt clods which could stick to tires).

4. All decontamination of equipment shall be done as required by Section 01020 and this section of these Specifications.

B. Loadout

1. All debris, such as concrete, asphalt, etc., shall be managed as described in Section 02010 of these Specifications.

2. All loadout of material will be done as required by these Specifications and the Work Plan prepared by the Contractor. Loading of trucks and other containers shall be done only in the loadout or equipment decontamination facilities.

3. Unless staging areas have been selected by the Contractor and approved by the Respondents or their Agent, fill, soil and debris will be loaded directly into trucks or containers as they are excavated, for transport to the rail terminal. Materials will be placed so they do not extend above the sides of the truck bed or container. Materials protruding above the sides of the truck or container will be pushed down or removed for placement into another truck or container by loading equipment or personnel.

4. Truck beds and containers will be tightly covered with tarps.

5. Truck drivers will generally not enter the Contamination Reduction Zone, but shall remain inside the truck when such entry is required.

C. Decontamination

1. After a truck or container has been loaded and tarped, it will be checked for contamination. The truck tires, body and outside of the bed and the outside of the container will be frisked to determine if contaminated fill or soil are present. If frisking does not detect any contamination, the equipment may be released for travel.

2. If frisking does detect contamination the truck or container will be decontaminated by wiping or spraying.

3. Following decontamination, all trucks and containers shall be frisked for release. If any radioactivity above release levels (see Table 02200-1 at the end of this section) is found, decontamination of those areas will be continued. If spraying or wiping is ineffective in removing contamination, brushes or other means shall be used until release levels are achieved. In no case shall a truck or container with radioactivity above the release levels be allowed to leave the site.

4. After containers are loaded and frisked for release, they- shall be staged in a clean area on the site. The trucks used to transport the containers to the rail yard will not need to be frisked prior to leaving the site, as long as the transport trucks do not enter the Contaminant Reduction Zone.

D. Transport

1. Trucks shall use only the designated route(s) to transport containers with contaminated materials from the Site and shall obey all signs, speed limits and other traffic laws. Any driver not obeying traffic laws, or the requirements of these Specifications, shall be removed from the work.

2. All trucks shall properly display a decal with all information required for transport of contaminated materials.

3. Each truck shall carry the standard industry bill of lading for each shipment.

4. All truck drivers shall have the training required by 29 CFR 1910.120 and shall be trained in the procedures to be used in the event of an emergency (see Section 01020, Articles 3.2 and 3.7, of these Specifications, and the Emergency Contingency Plan).

3.7 Fill

A. General

1. Unless otherwise specified, fill material shall be compacted by the Contractor to a density that is not less than 90% of the maximum density, standard proctor (ASTM D698).

2. The upper 18 inches of fill material placed in lawns and other areas to be revegetated shall not be compacted beyond that density needed to provide a stable land surface.

3. In areas where contaminated materials have been removed, the Contractor shall not begin backfilling until a radiological survey has been completed and sign-off has been obtained from the USEPA.

4. All fill shall be final graded to the requirements of Part 1 of this Section. After backfilling is completed, the fill (including topsoil) shall be graded to blend with existing contours where future construction will not be done.

B. Preparing Areas to be Filled

1. All vegetable matter and coarse material which might prevent compaction shall be removed by the Contractor from the surface upon which the fill is to be placed. Any loose and porous soils shall be removed or compacted to a depth specified by the Respondents or their Agent. The surface shall then be plowed or scarified until the surface is free from uneven features that would tend to prevent uniform compaction by the equipment to be used.

2. Where fills are constructed on hillsides or slopes, the slope of the original ground on which the fill is to be placed shall be stepped or keyed by the Contractor. The steps shall extend completely through the soil mantle, if any, and into the underlying formation materials.

3. Fill shall not be placed on ground which has frozen, unless the ground can be worked (e.g., scarified and recompacted) to remove the frost.

C. Placing and Spreading Fill Material

1. The Contractor shall not commence backfilling until a radiological survey of the excavation has been completed which verifies all contaminated materials have been removed as required by these Specifications, and the Field Team Leader has provided the Contractor with verbal authorization to begin backfilling.

2. Fill shall be placed to the line, elevation and grade as required by these Specifications, shown in the Work Plan, or described or shown in the Contractor's Work Plan for this Site. Unless otherwise approved in writing by the Respondents or their Agent, the Contractor shall use fill stakes to guide backfilling.

3. Salvaged fill or soil materials shall be used for backfilling unless determined unsuitable by the Respondents or their Agent.

4. When conditions require that contaminated fill or soil will be left in place, backfill will be placed against contaminated fill or soil. In this situation, a six mil polyethylene barrier will be placed to mark the separation between the fill or soil and to minimize the potential for contaminated fill or soil to fall into the "clean" area. Care will be taken during subsequent operations to prevent contaminated fill or soil from mixing with "clean" fill or soil.

5. Fill material to be compacted shall be placed by the Contractor in one foot , even, continuous layers. Each layer shall be spread evenly and shall be thoroughly mixed during the spreading to obtain uniformity of material in each layer.

6. Uniform moisture distribution in the fill to be compacted shall be obtained by discing, blading or other approved methods prior to compaction of a layer.

    a. When the moisture content of the fill material is insufficient to achieve specified density requirements, water shall be added by the Contractor until the moisture content is as specified.
    b. When the moisture content of the fill material is too high to achieve specified density requirements, the fill material shall be aerated by the Contractor by blading, mixing, or other satisfactory methods until the moisture content is reduced.

7. Unless otherwise shown in the Work Plan, the Contractor shall maintain a minimum of 10 feet of separation between excavation of contaminated fill or soil and placement of clean fill.

8. Fill on City of Chicago street rights-of-way shall be done as required by City of Chicago Standard Specifications.

D. Compaction

1. After each layer has been placed, mixed and spread evenly, it shall be thoroughly compacted by the Contractor to the required density (see below).

2. Compaction shall be accomplished by sheepsfoot rollers, vibratory rollers, multiple-wheel, pneumatic-tired rollers or other types of acceptable compacting equipment.

    a. Selection of compaction equipment will be at the discretion of the Contractor. Equipment shall be of such design that it will be able to compact the fill to the specified density.
    b. In areas not accessible to or suitable for larger self-propelled roller or vibratory equipment (e.g., small areas, within 12 inches over the top of utilities, etc.), the maximum loose-layer thickness will be four inches.
    c. Compaction shall be continuous over the entire area and the equipment shall make sufficient passes over the material to ensure that the desired density has been obtained over the entire area.
    d. The surface of fill slopes shall be compacted so that the slopes are stable and there shall be no excessive loose soil on the slopes.

3. Roadbase backfill shall be compacted to at least 95% of maximum density (ASTM D698 - standard proctor).

4. Common backfill shall be compacted as follows:

    a. To at least 90% of maximum density (ASTM D698 - standard proctor) for all areas except as noted below.
    b. To at least 95% of maximum density (ASTM D698 - standard proctor) for all areas to be covered with paving.
    c. To at least 95% according to ASTM D698 in City of Chicago street right of-ways where asphalt will be placed, except for the upper six-inch layer which will be compacted to not less than 100%.

5. Structural fill under buildings, slabs, ramps and stair shall be compacted to at least 95% of maximum density (ASTM D698).

6. Compaction will not be required in the upper 18 inches of soil placed in lawns or other areas to be revegetated.

E. When an area has been prepared to receive concrete or asphalt, applicable moisture and density requirements shall be maintained in the upper layer until the surface construction is completed.

F. The Contractor shall provide and maintain adequate erosion and drainage control facilities during the construction of the fill areas. The erosion control facilities shall be maintained in optimum condition until the work is complete. The facilities shall be inspected following significant rainfall, repairs made and excess sediment removed. It shall be the Contractor's responsibility to prevent the discharge of sediment offsite or to adjacent water courses.

G. Backfill around Utilities. In any case where utilities are disturbed or exposed, all repair work shall be done in accordance with the requirements of the utility, or the governing agency (see Appendix G - Specification 02840 Site Utilities).

3.8 Storage(Stockpiling)

A. On the Site

1. Non-radioactive materials, including fill, may be temporarily stockpiled on the Site in the locations noted in the Contractor's approved Work Plan, or as approved or directed by the Respondents or their Agent.

    a. As necessary, staged non-radioactive materials shall be covered or otherwise managed to control dust.
    b. Non-radioactive materials shall be removed from the vicinity of the property by the end of the work.

2. Radioactive materials may be staged (temporarily stored) on the Site in locations noted in the Contractor's approved Work Plan.

    a. If not in the approved Work Plan, radioactive materials may be staged on the Site only with written approval from the Respondents or their Agent. These materials shall only be stored on contaminated or specially prepared areas to minimize the potential for contamination of "clean" areas.
    b. Except when work is actively in progress, the staged materials shall be completely covered with impermeable plastic sheeting or other approved covers.

3.9 Disposal

A. At a minimum, all materials shall be disposed as required by the permits, these Specifications, and the laws, rules and regulations of the USEPA, State of Illinois, and the State of Utah.. All materials disposed off the Site shall be surveyed as required by SOP-345 to determine they are suitable for the intended disposal.

B. If the materials are disposed by landfilling or by recycling, the Contractor shall provide the Respondents or their Agent and the Project Coordinator with the name of the landfill or recycler.

1. The landfill and recycler must be qualified to receive the waste. Qualification information must be provided for the landfill or recycler, by the Contractor.

2. The Respondents or their Agent has the right to reject any landfill or recycler which does not meet qualification standards.

3.10 Landscaping

Following completion of backfilling to proper line, elevation and grade, the Contractor shall return to the site and reinstall or replace all designated items to at least original condition, or as otherwise agreed by the Respondents and the property owner. This includes paving, slabs, fences, retaining walls, sprinkler systems, sod, shrubs, bushes, trees and any other appurtenant landscaping, facilities and structures which were removed for or damaged by the work.

3.11 Surveying

A. A baseline will be established for the Site. This baseline will be tied to the previous USEPA survey done for the property.

B. Items including, but not limited to, the following will be located or identified in relation to the baseline.

1. Visible property boundaries.

2. Landscaping.

3. Facilities.

4. Structures.

5. Utilities.

6. Limits of radioactive contamination. Using the results of previous investigations and the baseline, sufficient stakes or markers will be placed to visibly mark the limits so any contaminated soil can be properly removed.

C. The baseline, as above, and the previous surveys also will be used to locate grids for verification surveying. The size of the grids will depend on the location and the extent of contamination.

D. The work for locating items such as the above can be done with equipment and materials such as the following:

1. Theodolite.

2. Compass.

3. Cloth or steel measuring tape.

3.12 Cleanup

Upon completion of work in this section, all rubbish, debris and excess fill or soil (including fill materials) shall be removed from the job site. All construction equipment and implements of service shall be removed and the entire area involved shall be left in a neat, clean and acceptable condition. Proper cleanup of the properties shall be a condition of acceptance of the work and final payment.

TABLE 02200-1
RELEASE CRITERIA

From U.S. NRC, Regulatory Guide 1.86, Table 1

Nuclide [a]	Average [b,c]	Maximum [b,d]	Removable [b,e]
U_{nat}, U_{235}, U_{238}, and associated decay products	5,000 dpm α per 100 cm^2	15,000 dpm α per 100 cm^2	1,000 dpm α per 100 cm^2
Transuranics, Ra_{226}, Ra_{228}, Th_{230}, Th_{228}, Th_{230}, Pa_{231}, Ac_{227}, I_{125} and I_{129}	100 dpm per 100 cm^2	300 dpm per 100 cm^2	20 dpm per 100 cm^2
Thnat, Th_{232}, Sr_{90}, Ra_{223}, Ra_{224}, U_{232}, I_{126}, I_{131} and I_{133}	1,000 dpm per 100 cm^2	3,000 dpm per 100 cm^2	200 dpm per 100 cm^2
Beta-gamma emitters (nuclides with decay modes other than alpha emission or spontaneous fission) except Sr_{90} and others noted above.	5,000 dpm β-γ per 100 cm^2	15,000 dpm β-γ per 100 cm^2	1,000 dpm β-γ per 100 cm^2

a Where surface contamination by both alpha- and beta-gamma-emitting nuclides exists, the limits established for alpha- and beta-gamma-emitting nuclides should apply independently.

b As used in this table, dpm (disintegrations per minute) means the rate of emission by radioactive material as determined by correcting the counts per minute observed by an appropriate detector for background, efficiency, and geometric factors associated with the instrumentation.

c Measurements of average contaminant should not be averaged over more than one square meter. For objects of less surface area, the average should be derived for each such object.

d The maximum contamination level applies to an area of not more than 100 cm^2.

e The amount of removable radioactive material per 100 cm^2 of surface area should be determined by wiping that area with dry filter or soft absorbent paper, applying moderate pressure, and assessing the amount of radioactive material on the wipe with an appropriate instrument of known efficiency. When removable contamination on objects of less surface area is determined, the pertinent levels should be reduced proportionally and the entire surface should be wiped.

510 NORTH PESHTIGO COURT
CHICAGO, ILLINOIS

Title: Site Utilities

Section 02840

Revision Number: 1

Date: December 16, 2015 Replaces: October 5, 2015

SECTION 02840

SITE UTILITIES

1.0 GENERAL

1.1 Scope

A. This section describes the general requirements for locating, protecting, removing and installing site utilities.

B. The known locations of utilities will be marked prior to start of work by utility locating contractors (DIGGER)..

1. Excavation to or below the locations of known utilities is expected as part of the work for the Site.

2. Utility lines and structures which are to remain in service shall be protected by the Contractor from any damage as a result of his operations.

3. All repair work, including backfilling, shall be done as required by the governing utility or agency. The Contractor shall contact the governing utility or agency and determine the requirements for properly completing the work.

1.2 Related Work

A. Other Part 1 Sections of these Specifications

B. Section 02010 - Demolition and Debris Removal

C. Section 02200 - Contaminated Material Loadout and Earthwork

1.3 Health and Safety

A. Detailed discussions of the potential hazards and the requirements for minimizing the potential for harm to project and offsite personnel, and to the environment, are provided in Section 01020 of these Specifications and the HASP.

B. All work shall be done under the supervision of personnel experienced and qualified for the work.

C. All work will be done as required by OSHA regulations published in 29 CFR 1910 and 1926. These regulations are included by reference in these Specifications.

D. Sampling and analyses of fill or soil from the Site indicate levels of radioactivity in the fill or soil above background levels. Based on the sampling and surveys, the work can proceed under Level D personal protection conditions (see HASP). Air, fill or soil monitoring and sampling will be done during the work to determine if modifications to Level D work conditions are necessary (see Section 02010). Complete descriptions of health and safety requirements for this Site are provided in Section 01020 of these Specifications and the HASP.

1. The Contractor shall be prepared to discontinue work in an area and begin work in an alternate area if monitoring and sampling indicate changes in the work conditions may be necessary and if so directed by AECOM.

2. The Contractor shall be prepared to begin working under changed conditions (greater than or equal to Level D personal protection with appropriate personal equipment and vehicle

decontamination) with minimal delay. The requirements which may be necessary if asphalt, concrete, wood, metal or other construction materials containing hazardous materials or levels of radiation above background are encountered are discussed in Section 02010 of these Specifications.

E. The Field Team Leader or Health and Safety Coordinator may bar any person from the Site who, in their opinion, shows a disregard for health and safety requirements.

1.4 Environmental Safeguards and Regulations

The Contractor shall comply with all federal, state, and local regulations, and the requirements of these Specifications at all times to prevent pollution of air, water and soil. Detailed requirements for the protection of the environment are provided in Section 01020 and the HASP.

1.5 Permits

A. The Contractor shall be responsible for obtaining all permits required for the work and additions described in this section of these Specifications.

B. Copies of all the necessary permits shall be provided to AECOM or their Agent and to the Project Manager prior to beginning the work.

C. At a minimum, all work shall be done in accordance with the requirements of the permits or, if the work is exempted under CERCLA from any permits, in accordance with the substantive requirements which would apply if the work were not exempted from such permits. The requirements of these permits are included by reference in these Specifications. Where the requirements of the permits and these Specifications are in conflict, the more stringent requirements shall apply.

1.6 Quality Assurance

A. Contractor personnel shall be persons qualified by education and experience to perform the duties assigned.

B. The Field Team Leader shall be a person qualified and experienced in the work described in these Specifications. AECOM will provide a Quality Assurance Officer to review all project submittals.

C. All work shall be done according to the requirements of these Specifications.

1.7 Submittals

All submittals shall be made to the AECOM or its Agent.

2.0 PRODUCTS

2.1 Backfill Materials

A. General. Fill materials shall be obtained from suitable stockpiles or borrow as defined in these Specifications. Materials containing organic (except topsoil), perishable, spongy, frozen, expansive or other deleterious materials shall not be acceptable.

B. Embedment. Embedment material shall be fine aggregate or sand as defined by Part 2 of Section 02200 of these Specifications.

2.2 Utilities

Materials used to reconstruct utilities shall be as required by the utility company, the governing municipal agency, or the building code.

3.0 EXECUTION

3.1 Location

A. The known locations of utilities shall be identified prior to the start of any excavation. The Contractor shall be responsible for field verifying utility locations and for obtaining any necessary additional information to properly implement and execute the Work Plan.

   1. Known and suspected utilities are shown on the current site survey. The locations as shown may prove to be inaccurate and other obstructions not shown may be encountered. Any reliance on this information will be at the Contractor's risk. The Contractor shall arrange to have all utilities located by the utility companies or a utility location service prior to beginning work (e.g., DIGGER).

   2. Excavations in the areas of suspected underground utilities shall be done in compliance with current regulations for protection of utilities for the City of Chicago.

B. Utility lines and structures which are to remain in service shall be protected by the Contractor from any damage as a result of his operations.

   1. Where utility lines or structures not shown on the site survey are encountered, the Contractor shall report them to AECOM or its Agent before proceeding with the work.

   2. Unless their excavation is necessary to allow work to proceed or as a result of contamination, the Contractor shall bear the cost of repair or replacement of any marked utility lines or structures which are broken or damaged by his operations.

   3. All repair work, including backfilling, shall be done as required by the governing utility or agency. The Contractor shall contact the governing utility or agency and determine the requirements for properly completing the work.

3.2 Existing Utilities Designated for Excavation

A. Overhead Utilities shall be removed and replaced by the utility if such is necessary for proper completion of the work. If the utility will not or cannot remove them, procedures for excavation will be discussed with and approved by the utility. At a minimum, removal of overhead utilities shall include the following.

   1. Obtain the necessary disconnects and verify the utilities are de-energized and grounded prior to the work.

   2. Remove cables and guy-wires from the utility poles.

   3. Determine if the above- and below-grade sections of the poles are contaminated with radiological materials.

      a. If the above-grade sections are not contaminated and the lower section is, or if the potential for contamination of the below-grade section is unknown, fell above-grade sections of utility poles by sawing or other suitable methods to separate the uncontaminated above-grade sections from the potentially contaminated below-ground section.

b. If both sections are contaminated, the pole may be removed by felling the above-grade part and excavating the below-grade part, or by pulling the pole from the ground with a crane or other equipment.

4. Uncontaminated components of overhead utilities, such as cables, guy-wires, etc., shall be disposed as required by Section 02010 of these Specifications.

5. Contaminated components of overhead utilities shall be removed and processed for loadout and disposal as other contaminated debris (see Section 02010 of these Specifications).

6. Excavated materials shall be handled as required by Subparts 3.5, 3.6, 3.8 and 3.9 of Section 02010 of these Specifications.

B. Underground Utilities to be removed may be removed by the utility. At a minimum, the following procedures shall be used.

1. Obtain the necessary disconnects or shutoffs prior to the work and verify the utility is de-energized, drained, or purged as necessary (lock-out and tag-out procedures properly implemented).

2. Excavate and manage materials to access contaminated utilities or bedding materials as required in Subparts 3.5, 3.6, 3.8 and 3.9 of Section 02010 of these Specifications. Monitoring of excavations will be required both on-site and in adjacent rights-of-way.

3. Remove, decontaminate and dispose of contaminated utility materials as required in subparts 3.5, 3.6, 3.8 and 3.9 of Section 02010 of these Specifications.

4. Replace, repair, or abandon the removed utility as directed by these Specifications and the Work Plan, or the utility company or municipal agency having jurisdiction.

a. Replacement or repairs of the utilities shall be in accordance with the requirements of these Specifications or the utility or agency.

b. Abandoned utilities shall be capped as required by Article 3.3 of this section.

3.3 Underground Utilities Encountered During Excavation

A. Damage to utilities shall be repaired under the supervision of the respective utility service or municipal agency having jurisdiction.

B. Abandoned utilities shall be cleaned of all encrusted contamination. Open ends or broken pipes shall be properly capped.

1. At a minimum, capping may be done by crimping, pouring concrete around, or plugging the open end in such a way as to prevent a "least path of resistance" for any future gas leaks.

2. Capping will be done as required by the utility or municipal agency if their requirements exceed those above.

C. Active utilities shall be supported in-place, if suitable, or removed and replaced as necessary to excavate to the depths shown in the Work Plan.

1. Support or removal and replacement shall comply with the more stringent requirements of the affected utility or municipal agency or these Specifications.

2. Utility lines, whether removed or left in-place, shall be cleaned of encrusted contamination as required and described by Section 02010 of these Specifications.

3. Removed utilities shall be managed and disposed as required in Section 02010 for other demolition debris.

3.4 Underground Utility Installations

A. The Contractor shall coordinate interruptions of utility services through AECOM or its Agent.

B. If utilities are installed after backfilling is complete, all excavations shall be by open cut.

1. The banks of the trenches should be as vertical as possible. Shoring and bracing, as necessary shall be designed by a qualified Professional Engineer competent in soils engineering. The design of shoring and bracing shall be provided to AECOM or its Agent.

2. If rock is encountered, the base of the trench will be overexcavated at least six inches to allow for placement of bedding material.

C. If utilities are installed before backfilling is completed to final line, elevation and grade, the fill shall be to at least 12 inches above the top of the utility before excavation and placement of the utility is begun.

D. Trench Preparation. The bottom of the trench shall be accurately excavated to line, and graded and shaped to fit the lower one-quarter of the pipe to provide uniform bearing and support for each section; wedging and blocking will not be permitted. If the pipe has bell ends, the trench shall be overexcavated at the joints. If the common fill is granular, the base of the trench shall be scarified to a depth of six inches and recompacted to at least 95% of maximum density at ±2% of optimum moisture (standard proctor, ASTM D698). If the common backfill is not granular in nature, the base of the trench shall be overexcavated six inches and backfilled with granular (embedment) material compacted to at least 95% of maximum density at ±2% of optimum moisture.

E. Utility Embedment, All utility lines except electric lines and irrigation lines two inches or less in diameter shall be embedded in fine aggregate (see Subpart 2.1.13 of this section).

1. Embedment material shall extend a distance equivalent to the utility diameter above, below and to the sides of the utility for utilities greater than six inches in diameter. A six-inch embedment shall be provided for utilities less than or equal to six inches in diameter.

2. Care shall be taken not to disturb either the horizontal or vertical alignment of the utility; embed both sides of the utility simultaneously. If necessary, compact embedment material by hand to avoid displacement and damage to the utility.

F. All utility installations shall be inspected by AECOM, and by the utility or municipal agency if necessary, at the following times.

1. Before placing embedment material over the utility.

2. Before placing common fill over the embedment material.

G. Compaction of common material over the utility shall be by manually-operated power equipment or by hand until at least 12 inches of fill has been placed over the utility. Damage to the utility by compaction or other causes after proper installation shall be the responsibility of the Contractor.

H. Tests. Testing shall be done on all repaired or replaced systems. Testing may be done by the utility or municipal agency or Contractor. All testing will be done as required by the utility, municipal agency or applicable building code. All testing will be done in the presence of AECOM, and utility, municipal agency or building inspectors, as necessary.

APPENDIX H

Field Gamma Survey Form

AECOM

Sheet ___ of ___

RADIATION SURVEY FORM - GENERAL

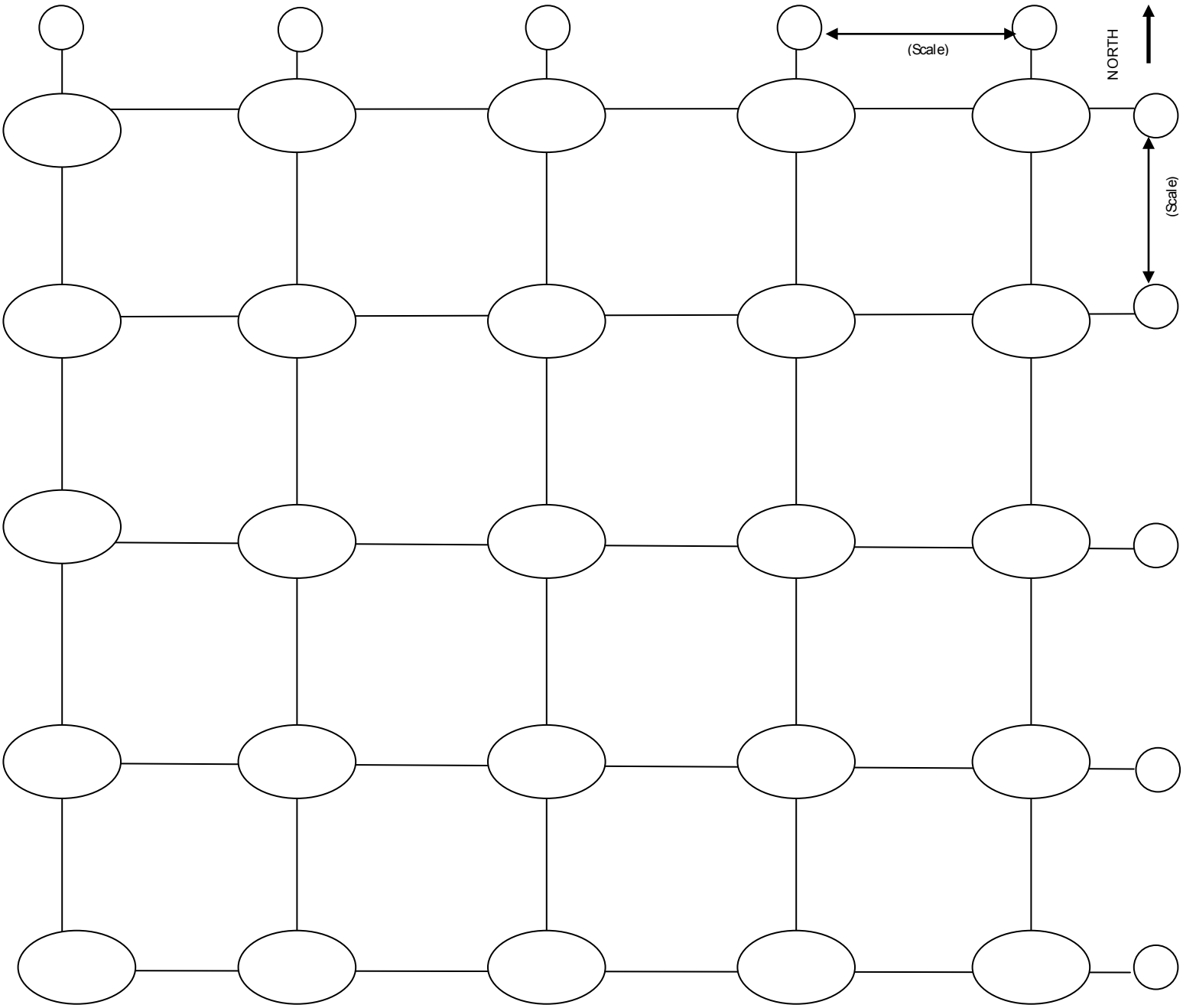
Project No.: 60443727 Project Name: 510 N. Peshtigo Ct.

Date: _____ Technician: _____

Inst. Model: _____ Serial No.: _____

Inst. Calibration Date: _____ Lift Elevation: _____

Write grid designations in circles. Indicate excavated area with heavy line. Record counts at intersections in Counts Per Minute (CPM). Indicate areas with audible alarms by shading the area.



APPENDIX I

Health and Safety Plan

510 NORTH PESHTIGO COURT
CHICAGO, ILLINOIS

Title: Health and Safety Plan

Revision Number: 1

Date: December 16, 2015

Replaces: October 3, 2015

TABLE OF CONTENTS

EMERGENCY PHONE NUMBERS

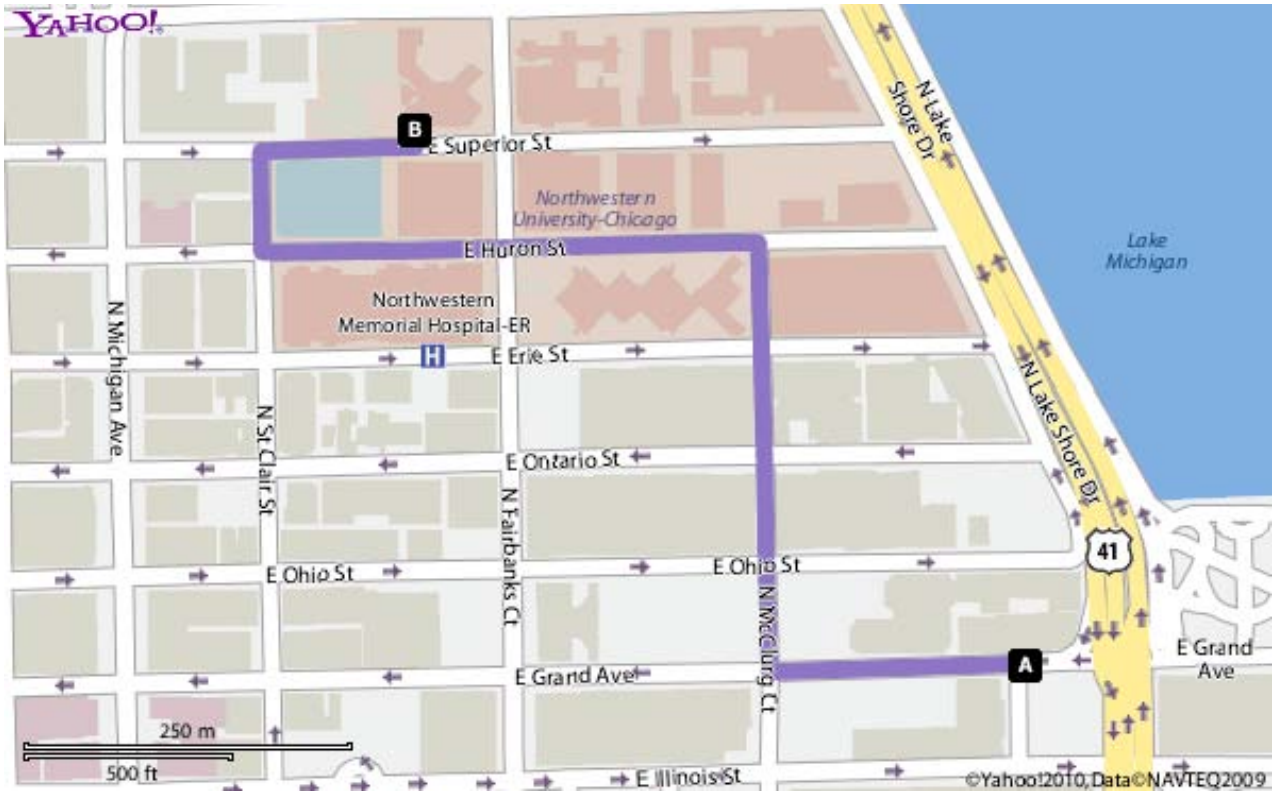
IN THE EVENT OF AN EMERGENCY DIAL 911

AMBULANCE SERVICE	911
FIRE DEPARTMENT	911
EMERGENCY RESCUE SERVICE	911
POLICE DEPARTMENT	911
NATIONAL RESPONSE CENTER	(800)-424-8802
POISON CONTROL CENTER	(800)-732-2200
NORTHWESTERN MEMORIAL HOSPITAL	(312) 908-2000
PROJECT COORDINATOR (Steve Kornder)	(262)-515-7700 cell
ILLINOIS EMERGENCY MANAGEMENT AGENCY (IEMA) - Division of Nuclear Safety	(800) 782-7860 [1]
USEPA REGION 5 24-HOUR EMERGENCY NUMBER	**(312) 353-2318**

[1] Primary notification should be made to USEPA Region 5. The IEMA emergency number can be used as a secondary notification number.

Hospital Location and Directions

Northwestern Memorial Hospital
250 E. Superior Street
Chicago, IL 60611



Directions:

1.	**Start at 510 N PESHTIGO CT, CHICAGO going toward N MCCLURG CT**	**go 0.1 mi**
2.	**Turn Right on N MCCLURG CT**	**go 0.2 mi**
3.	**Turn Left on E HURON ST**	**go 0.3 mi**
4.	**Turn Right on N ST CLAIR ST**	**go 0.1 mi**
5.	**Turn Right on E SUPERIOR ST**	**go 0.1 mi**
4.	**Arrive at 250 E SUPERIOR ST, CHICAGO, on the left**	

EMERGENCY PLAN

In the event excavation within the potentially contaminated area (site specific) is required on an emergency basis, the following shall be incorporated to the extent possible, and all personnel working in the potentially contaminated areas shall be given the opportunity to read this section of the Health and Safety Plan (HASP). The remainder of the attached HASP will be implemented as conditions allow.

A. PROTECT WORKERS POTENTIALLY EXPOSED TO CONTAMINATED SOIL OR FILL

1. Notify workers that levels of radiation above background levels may be present in excavated soil or fill.
2. Avoid ingesting soil or fill.
   Avoid inhaling dust from contaminated areas.
   Minimize contact with the soil or fill or fill to the extent possible.
   Wear protective coveralls or disposable coveralls to facilitate cleanup of workers.
3. Screen excavation for gamma radiation (NaI detector).

B. AVOID SPREAD OF CONTAMINATION

1. Limit erosion transport of excavated soil or fill or fill through use of hay bales, sand bags, temporary berm
   materials to minimize uncontrolled runoff.
2. Cover any excavated soil or fill or fill piles until screened for potential contamination.
3. Screen soil or fill or fill prior to transport away from project site using NaI gamma detector.
4. Do not remove equipment which has been in contact with potential contamination until it has been checked and released.

C. MINIMIZE POTENTIAL PUBLIC CONTACT.

1. Limit access to excavated soil or fill or fill using barricades, temporary fencing, jersey barriers.
2. Cover excavated piles to minimize fugitive dust. Wet dusty excavations.
3. Control, to the extent possible, off-site tracking by vehicles, potentially contaminated boots or clothing by workers.

D. MONITOR CONTAMINATION

1. To the extent practicable, provide gamma radiation screening of the exposed soil or fills or fills in the excavation (NaI detector).
2. When possible, provide high volume air samplers immediately adjacent to potential or known exposed contaminated soil or fill or fill, to monitor for fugitive emissions (dust, radon gas).
3. Survey ground surface/pavement surface around potential or known contamination locations for elevated gamma radiation (NaI detector).

E. DISPOSAL

1. Any excavated material should be disposed as required by law.

F. NOTIFY AUTHORITIES

1. Notify agencies identified on the enclosed emergency notification list.

   Notification should include, as a minimum, the following
   1. Location of Excavation
   2. Potential Contact with Thorium Containing Soil or fill or Fill
   3. Field surveys and sampling measured a maximum reading of _____ cpm (if readings have been taken) in soil or fill or fill remaining, although higher concentrations may be present.

1.0 SCOPE OF PLAN

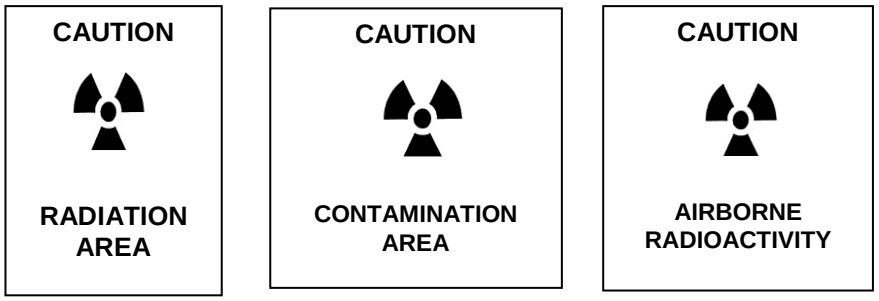
The following Health and Safety Plan (HASP) will be utilized and modified as necessary in order to minimize and prevent exposures to hazardous substances and conditions related to all excavation and restoration activities at the Site. All personnel assigned to this project will be required to review thoroughly the contents of the HASP and to strictly adhere to the policies and procedures listed herein. This HASP is for use only by AECOM as the remediation manager and by their designated contractors and consultants, and approved Site visitors. USEPA, and other agencies, are not considered visitors and will be required to conform to their own Health and Safety Plans.

This plan meets the requirements of OSHA 29 CFR 1910.120, Hazardous Waste Operations and Emergency Response, and applicable subparts of OSHA 29 CFR 1926, 1910 and 10 CFR. Visitors will be required to review the health and safety plan and read and sign the visitor information sheet (Figure 1.1).

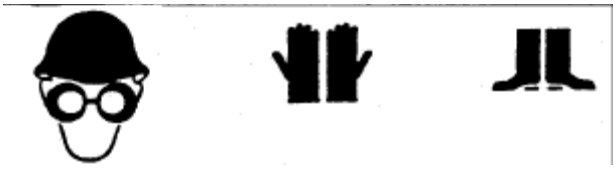
FIGURE 1.1
VISITOR INFORMATION SHEET

NOTICE TO VISITOR: ALL VISITORS MUST BE ESCORTED AT ALL TIMES WHILE ON THIS SITE.

CAUTON. Radioactive materials may be present on this site. Radioactive materials may be found throughout the site. Grounds, and equipment have low levels of contamination.



CONTROLLED AREAS: Do not enter areas with these signs unless you have an escort or health physics has given specific approval and you understand access limitations.



You must wear protective clothing in controlled areas. Health physics will provide you with instructions.

You must wear a personal radiation dosimeter if you enter an area which is controlled.

No smoking, eating, drinking or chewing in controlled areas.
NO EXCEPTIONS.

.Notify Health Physics if you do not understand these instructions.

Signature_____ Date _____

2.0 SAFETY MANAGEMENT

The following safety management structure, Figure 2.1, will be utilized for the implementation, administration, and monitoring of the HASP.

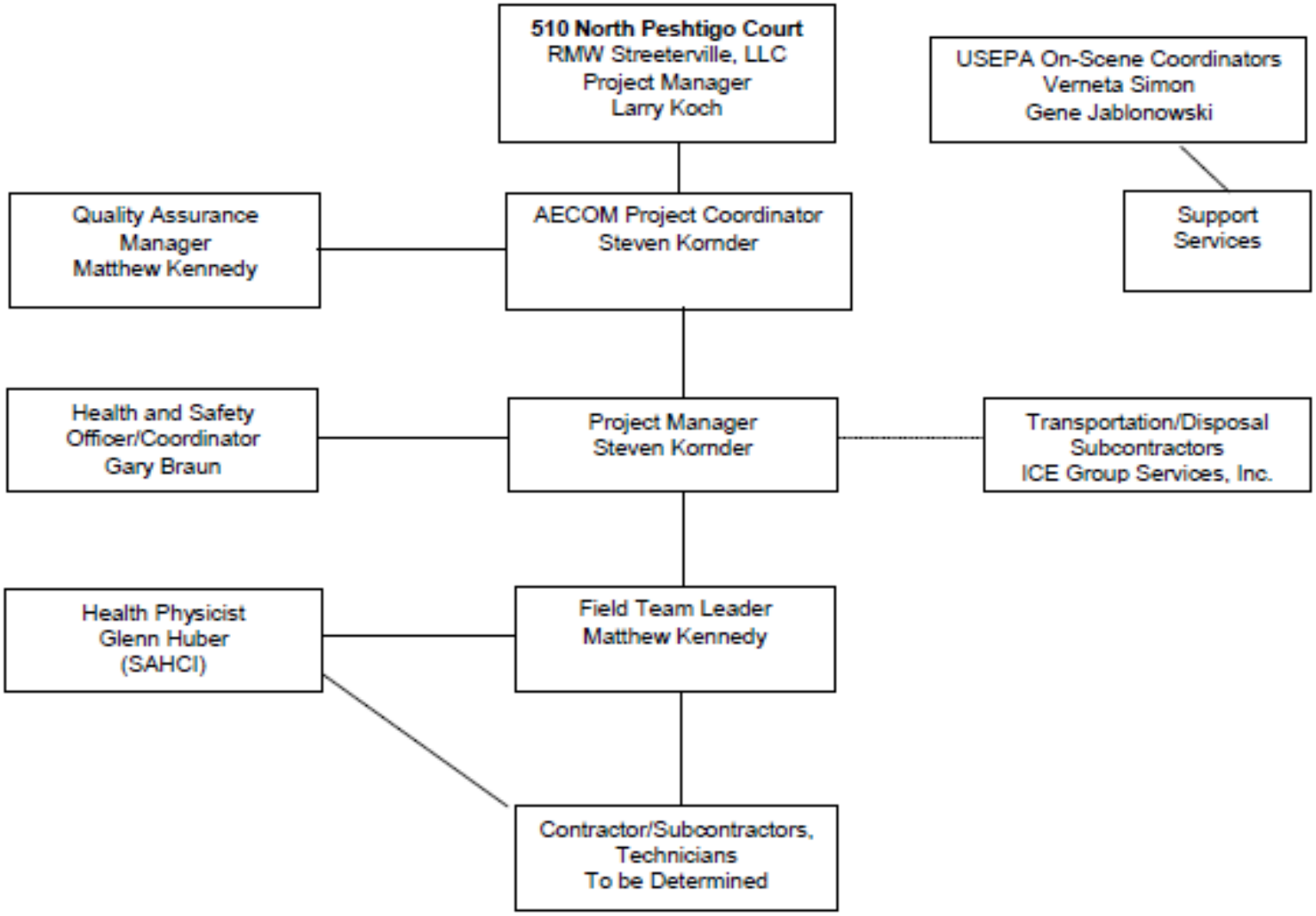
2.1 Health and Safety Coordinator

The Health and Safety Coordinator (HSC) shall assume overall responsibility for the HASP. The HSC or designee shall monitor and maintain quality assurance of the HASP until project completion. Principal duties of the HSC include:

- Review project background data,
- Approve all HASP modifications,
- Administer and enforce the HASP,
- Evaluate the adequacy of personal protective equipment (PPE) to be used by Site personnel,
- Conduct required on-site training except tailgate safety meetings that will be conducted by the Field Team Leader,
- Brief visitors on work Site conditions, and
- Administer personnel and perform ambient air monitoring procedures.

The HSC or designee has the authority to stop work in the event conditions develop which pose an unreasonable risk to Site personnel or persons in the vicinity.

PROJECT MANAGEMENT ORGANIZATION CHART



3.0 PERSONNEL RESPONSIBILITIES

The HSC or designee will administer and supervise the HASP at the work-site level. He will monitor all operations and will be the primary on-site contact for health and safety issues, and will have full authority to stop operations if conditions are judged to be hazardous to on-site personnel or the public.

The HSC will brief all Site personnel on the contents of the HASP. Personnel will be required to review the HASP, and have the opportunity to ask questions about the planned work or hazards. The Field Team Leader will conduct tailgate safety meetings to familiarize the Site personnel with Site conditions, boundaries, and physical hazards. Site personnel will conduct their assigned tasks in accordance with the HASP at all times. As necessary, the Field Team Leader will conduct radiation training and provide briefings on radiation issues that arise during construction. These activities will take place as part of the tailgate safety meetings, or during special meetings to address more immediate concerns, dependent on the issues being addressed.

If at any time Site personnel observe unsafe conditions, faulty equipment or other conditions which could jeopardize personnel health and safety, they are required to immediately report their observations to the HSC or Field Team Leader.

Work zones will be established at the Site. These zones include clean/support zones, decontamination zones, and exclusion zones. Although the clean/support zones are anticipated to remain fixed, other zones will move about the Site as excavation work progresses.

4.0 HAZARD ASSESSMENT

The following represents potential hazards associated with this project.

4.1 Principal Contaminants (Known or Suspected)

Radioactive Contamination:

- Thorium: the entire thorium (Th-232) decay chain
- Uranium: the entire uranium (U-238) decay chain
- Actinium: the entire uranium (U-235) decay chain
- Radium: Ra-226 and Ra-228
- Radon: Rn-220 and Rn-222

The known total radium concentration present in the soil or fill or fill potentially exceeds 100 pCi/g for some locations within the project site. The following primary routes of entry to the body will be considered:

Route	Entry Made Via
Inhalation	Airborne dust containing heavy metal radionuclides and radon.
Ingestion	Airborne dust containing heavy metal radionuclides/contaminants. Improper or poor personal hygiene practices.
Eye and Skin	Direct contact with contaminants. Improper or poor personal hygiene practices. Airborne dust containing heavy metal/radionuclide contaminant. Cuts and abrasions.
Direct Exposure	Penetrating gamma radiation in air, soil or fill or fill. Exposure to X-rays.
Chemical Contamination	Polynuclear Aromatic Hydrocarbons (PAHs)

PAH contamination is present in the urban fill materials on site. These materials include coal cinders, ash and fire debris. Typical PAH concentrations are in the low part per million range.

The use of personal protective equipment, proper procedures and dust suppression activities will minimize any hazard to site personnel from either the elevated radioactivity or PAH contamination. Specific safety procedures will be covered in subsequent sections of this Site Safety Plan.

Route	Entry Made Via
Inhalation	Airborne dust
Ingestion	Airborne dust Improper or poor personal hygiene
Skin and Eye	Direct contact with contaminated soil or fill or fill Improper or poor personal hygiene Airborne dust Cuts and abrasions

4.2 Physical Hazards

Before field activities begin, the HSC will conduct a Site reconnaissance to identify any real or potential hazards created from Site activities. Physical hazards inherent to construction activities and power-operated equipment may exist.

4.2.1 Heat Stress

Field activities in hot weather create a potential for heat stress. The warning symptoms of heat stress include fatigue; loss of strength; reduced accuracy, comprehension and retention; and reduced alertness and mental capacity. To prevent heat stress, personnel shall receive adequate water supplies and electrolyte replacement fluids, and maintain scheduled work/rest periods.

The Field Team Leader or designee shall continuously visually monitor personnel for signs of heat stress. In addition, field personnel will be instructed to observe for symptoms of heat stress and methods on how to control it. One or more of the following control measures can be used to help control heat stress.

- Provision of adequate liquids to replace lost body fluids. Employees must replace body fluids lost from sweating. Employees must be encouraged to drink more than the amount required to satisfy thirst, 12 to 16 ounces every half-hour is recommended. Thirst satisfaction is not an accurate indicator of adequate salt and fluid replacement. Replacement fluids can be commercial mixes such as Gatorade.

- Establishment of a work regimen that will provide adequate rest periods for cooling down. This may require additional shifts of workers.

- Breaks should be taken in a cool and shaded rest area (77 degrees is best).

- Employees shall remove impermeable protective garments during rest periods.

- Employees shall not be assigned other tasks during rest periods.

- All employees shall be informed of the importance of adequate rest, acclimation, and proper diet in the prevention of heat stress.

4.2.2 Cold Stress

Field activities are anticipated during cold weather during a period when temperatures average below freezing. The following guidelines will be followed.

Persons working outdoors in temperatures of 40 degrees and below may suffer from cold exposure. During prolonged outdoor periods with inadequate clothing, effects of cold exposure may even occur at temperatures well above freezing. Cold exposure may cause severe injury by freezing exposed body surfaces (frostbite) or result in profound generalized cooling, possibly causing death. Areas of the body which have high surface area-to-volume ratios such as fingers, toes and ears are the most susceptible to frostbite.

Two factors influence the development of a cold injury: ambient temperature and the velocity of the wind. Wind chill is used to describe the chilling effect of moving air in combination with low temperature. For instance, 10° F with a wind of 15 miles per hour (mph) is equivalent in chilling effect to still air at -18°F.

As a general rule, the greatest incremental increase in wind chill occurs when a wind of 5 mph increases to 10 mph. Additionally, water conducts heat 240 times faster than air. Thus, the body cools suddenly when external chemical-protective equipment is removed if the clothing underneath is perspiration-soaked.

Local injury resulting from cold is included in the generic term "frostbite". There are several degrees of damage. Frostbite of the extremities can be categorized into:

- Frost nip or incipient frostbite: Characterized by sudden blanching or whitening of skin.

- Superficial frostbite: Skin has a waxy or white appearance and is firm to the touch, but tissue beneath is resilient.

- Deep frostbite: Tissues are cold, pale, and solid; extremely serious injury.

Prevention of frostbite is vital. Keep the extremities warm. Wear insulated clothing as part of one's protective gear during extremely cold conditions. Check for symptoms of frostbite at every break. The onset is painless and gradual - you might not know you have been injured until it is too late.

To administer first aid for frostbite, bring the victim indoors and rewarm the areas quickly in water 95° to 100°F. Give individual a warm drink - not coffee, tea, or alcohol. The victim should not smoke. Keep the frozen parts in warm water or covered with warm clothes for 30 minutes, even though the tissue will be very painful as it thaws; then elevate the injured area and protect it from injury. Do not allow blisters to be broken. Use sterile, soft, dry material to cover the injured areas. Keep victim warm and get immediate medical care.

4.2.3 Electrical Hazards

Overhead power lines, downed electrical wires, buried cables and improper use of electrical extension cords can pose a danger of shock or electrocution. All Site personnel should immediately report to the Field Team Leader any condition that could result in a potential electrical hazard.

The Field Team Leader will notify Site personnel during the safety meetings of the locations of known underground cables and utilities.

4.2.4 Noise Hazard

Operation of equipment may present a noise hazard to workers. Site personnel will utilize hearing protection when noise levels are determined to be in excess of 29 CFR 1910.95 requirements. Noise monitoring will be performed by the HSC as needed.

4.2.5 Overt Chemical Exposure

Typical response procedures include:

SKIN CONTACT:
Use copious amounts of soap and water. Wash/rinse affected area thoroughly, then provide appropriate medical attention. Eye wash will be provided on-site at the work zone and support zone as appropriate. If affected, eyes should be continuously flushed for a minimum of 15 minutes.

INHALATION:
Move to fresh air and transport to hospital. Decontaminate as other actions permit.

INGESTION:
Transport to emergency medical facility. Decontaminate as permitted by other requirements.

PUNCTURE WOUND OR LACERATIONS:
Transport to emergency medical facility. Field Team Leader will provide chemical safety information to medical personnel as requested. Decontaminate as permitted by other requirements.

4.2.6 Adverse Weather Conditions

In the event of adverse weather conditions, the Field Team Leader will determine if work can continue without endangering the health and safety of field workers. Some items to be considered before determining if work should continue are:

- Potential for heat stress and heat-related injuries.
- Potential for cold stress and cold-related injuries.
- Treacherous weather-related working conditions.
- Limited visibility.
- Potential for electrical storms or high winds.

4.3 Medical Evaluation and Surveillance Program

All field project personnel shall receive a medical evaluation in accordance with 29 CFR 1910.120. Personnel who receive a medical evaluation will be notified by the medical contractor as to the outcome of their evaluation. This will be in the form of a confidential report addressed to the individual and will contain a breakdown of the clinical findings. In addition, it will indicate any areas of concern which would justify further medical consultation by the individual's personal physician. In the event that the areas of concern are of a severe nature, a follow-up notification will be made to the individual by the medical consultant to answer any questions the employee may have.

4.3.1 Dosimetry/Personnel Monitoring

Project personnel involved with remediation activities within an exclusion zone will participate in a dosimetry program administered by the HSC. (The dosimetry program shall comply with 32 IAC 340[1], i.e., dosimeters will be processed by a dosimetry processor accredited by the National Voluntary Laboratory Accreditation Program.) The HSC shall maintain records of all radiation exposures incurred by field personnel including all contractors. These records will be maintained in an up-to-date manner to comply with the requirements of 32 IAC 340.4010. The HSC shall review the results of personal exposure monitoring to determine compliance with exposure limit requirements.

4.3.2 Requirement for Dosimetry

Personal dosimetry is required for anyone who enters a radiologically controlled area in which he/she may receive in one calendar year a dose in excess of 10% of the limits in 32 IAC 340. Any person who works in a radiation area will be required to have a personal dosimeter. As a matter of policy, individuals will be required to use a dosimeter (either self-reading type, film badge, Thermoluminescence Detector (TLD) or Optically Stimulated Luminescence Dosimeter (OSL)) whenever they enter the Exclusion Zone.

4.3.3 Bioassay

Bioassay is the determination of the types and amounts of radioactive materials, which are inside the body. By analyzing the rate of deposition, the rate of excretion, and any other available information regarding placement in the body, internal exposures from radioactive materials can be estimated.

Procedures for bioassay will be consistent with the previous Lindsay Light Health and Safety Plan. Bioassays are not anticipated to be required for the excavation and removal activities proposed, based on levels documented as present.

The decision to use bioassay will be made by the Health and Safety Coordinator. In the event that a worker has an excessive intake or the potential to receive greater than 10% of the Annual Limit on Intake (ALI) , bioassay shall be ordered. Data from Lapel Air Samplers shall be used as a factor in determining whether or not bioassay is warranted. If workers are found to have been present in locations where airborne radioactivity concentrations are found to be greater than 30% of the Derived Air Concentration, bioassay will be considered.

[1] The IDNS regulations are usually more restrictive than US Nuclear Regulatory Commission (NRC) regulations. However, if there is a conflict between IDNS and NRC regulations, the NRC regulations will be used to determine compliance.

4.3.4 Emergency Medical Treatment

Emergency first aid should be administered on-site as appropriate. The individual should be decontaminated if possible, depending on the severity of the injury, and transported to the nearest medical facility, if needed. Treatment of the injury is of primary concern and decontamination a secondary concern. Levels of radioactive contamination at the Site could be acutely hazardous if decontamination is not undertaken during an emergency situation. The Field Team Leader will complete the appropriate incident report, if warranted. See Section 4.4, Accident and Incident Reporting.

An emergency first-aid station will be established and will include a first-aid kit for onsite emergency first aid.

Provisions for emergency medical treatment shall be integrated with the following guidelines:

- At least one individual qualified to render first aid and Cardiopulmonary Resuscitation (CPR) will be assigned to each shift.
- At least one individual trained in radiation emergency response will be assigned to each shift
- Emergency first aid stations in the immediate work vicinity.
- Conspicuously posted phone numbers and procedures for contacting ambulance services, fire department, police, and medical facilities.
- Maps and directions to medical facilities.
- Conspicuously posted evacuation routes and gathering area locations shall be posted around the Site.

4.4 Accident and Incident Reporting

All accidents, injuries, or incidents will be reported to the HSC. This accident/incident will be reported as soon as possible to the employee's supervisor. An Accident/Incident Form will be completed by the Field Team Leader, and a copy will be forwarded to the AECOM Project Manager. A copy of the form is shown as Figure 4.1.

FIGURE 4.1
ACCIDENT/EXPOSURE INVESTIGATION REPORT

COMPANY			DATE
INVESTIGATION TEAM			
EMPLOYEE'S NAME & ID			
SEX	AGE	JOB DESCRIPTION	
DEPARTMENT & LOCATION			
ACCIDENT DATE & TIME			
DATE & TIME ACCIDENT REPORTED TO SUPERVISOR			
NATURE OF INCIDENT			
NATURE OF INJURY			
REFERRED TO MEDICAL FACILITY/DOCTOR ☐ YES ☐ NO			
EMPLOYEE RETURNED TO WORK ☐ YES DATE/TIME _____ ☐ NO			
☐ INJURED EMPLOYEE INTERVIEW/STATEMENT - ATTACHED			
WITNESSES			
☐ WITNESSES INTERVIEWS/STATEMENTS ATTACHED			
☐ PHOTOGRAPHS OF SITE - ATTACHED			
☐ DIAGRAMS OF SITE - ATTACHED			
EQUIPMENT RECORDS - ATTACHED - REVIEWED	☐ YES	☐ NO	
ACCIDENT/EXPOSURE INCIDENT DESCRIPTION			

FIGURE 4.1
ACCIDENT/EXPOSURE INVESTIGATION REPORT

ACCIDENT DESCRIPTION			
DATE & TIME	LOCATION		
EMPLOYEES INVOLVED			
PREVENTIVE ACTION RECOMMENDATIONS			
CORRECTIVE ACTIONS COMPLETED	MANAGER RESPONSIBLE	DATE COMPLETED	
EMPLOYEE LOST TIME - TEMPORARY HELP - CLEANUP - REPAIR - DISCUSSION			
ACCIDENT COST ANALYSIS	INVESTIGATION	COMPLIANCE	TOTAL COST
MEDICAL			
PRODUCTION LOSS			
REPORT PREPARED BY	DATE COMPLETED		
SAFETY COMMITTEE REVIEW	☐ YES	☐ NO	
CORRECTIVE ACTION	DATE STARTED		
SAFETY COMMUNICATION NOTICE PREPARED	DATE		
SAFETY DIRECTOR SIGNATURE			

FIGURE 4.1
ACCIDENT/EXPOSURE INVESTIGATION REPORT

ACCIDENT DESCRIPTION	
DATE & TIME	LOCATION
EMPLOYEES INVOLVED	

EMPLOYEE INTERVIEW/STATEMENT - INJURED EMPLOYEE - WITNESS
EMPLOYEE NAME
INTERVIEWED BY

ACCIDENT DIAGRAM/PHOTOGRAPHS

5.0 TRAINING

All Site personnel potentially in contact with contaminated soil or fill and fill or who are involved in the excavation and/or loading for transport of radiologically-contaminated soil or fill or fill shall be trained and certified in accordance with 29 CFR 1910.120.

5.1 Project- and Site-Specific Training

Prior to project start-up, all assigned personnel shall receive an initial project- and site-specific training session. This training shall include, but not be limited to, the following areas:

- Review of the Health and Safety Plan;
- Review of general radiation principles and compounds;
- Review of applicable radiological chemical and physical hazards;
- PPE levels to be used by Site personnel;
- Site security control;
- Emergency response and evacuation procedures;
- Project communication;
- Required decontamination procedures;
- Prohibited on-site activities;
- Instructions to workers in accordance with 10 CFR 19.12; and
- U.S. NRC Regulatory Guide 8.13 and Declared Pregnant Woman Policies (Females).

5.2 Visitor Orientation

All non-essential personnel and visitors who plan to enter the exclusion zone will be briefed on the HASP requirements and 10 CFR 19.12 requirements prior to entry with a trained Site escort. In addition, female visitors will be instructed regarding U.S. NRC Regulatory Guide 8.13 and Declared Pregnant Woman Policies.

5.3 Safety Tailgate Meetings

Before the start of the work week, on Monday morning, the Field Team Leader will assemble the Site personnel for a brief safety meeting. Additional meetings will be conducted throughout the week, as needed, to address safety concerns and precautions. The purpose of these meetings will be to discuss project status, problem areas, conditions, safety concerns, PPE levels and to reiterate HASP requirements. The Field Team Leader will complete a Safety Meeting Report (Figure 5.1) to indicate the contents of the meeting and the attendees.

5.4 First Aid

At least one (1) individual, trained and qualified to administer first aid and CPR in accordance with American Red Cross requirements, who is also trained in radiological response, will be present at the Site.

5.5 Safe Work Permit

Site workers in special work conditions such as confined space, hot work, trenching, or other physical hazards, must be skilled at such work and trained to recognize these as special work conditions. Confined space is defined by OSHA 1910.146. Section 13 of this HASP contains further information on the confined space program to be followed.

Figure 5.2 shows the Safe Work Permit to be completed by the HSC and signed by workers for special work conditions.

Figure 5.3 show the issues which will be addressed in the event soil or fill or fill is encountered which exhibits low level contamination. The potential low level contamination includes the presence of possible residual petroleum products from an existing or former underground storage tank or other source of fuel or polynuclear aromatics hydrocarbons (PAHs) contamination, such as tar, cinders, or coal ash.

FIGURE 5.1
SAFETY MEETING REPORT (Page 1 of 2)

DATE		DURATION OF MEETING	
		FROM: ☐ A.M. ☐ P.M.	TO: ☐ A.M. ☐ P.M.
NUMBER PRESENT	NUMBER ABSENT	MEETING CONDUCTED BY	DID MEETING INCLUDE REQUIRED TRAINING? ☐ YES (DESCRIBE BELOW) ☐ NO

HEALTH AND SAFETY COORDINATOR'S PRESENTATION	DISCUSSION OF SAFE/UNSAFE WORK PRACTICES, MATERIALS, PRECAUTIONS, HAZARDS, EQUIPMENT FAMILIARIZATION, ETC.
SITE WORKER FEEDBACK	COMMENTS, QUESTIONS, COMPLAINTS, ETC.
HEALTH AND SAFETY COORDINATOR'S CORRECTIVE ACTION PLAN	KNOWN PLANS FOR CORRECTION, PARTS ON ORDER, ITEMS TO BE DISCUSSED WITH DEPART. HEAD, AND CORRECTION OF ITEMS PREVIOUSLY SUBMITTED
PROJECT MANAGER'S COMMENTS	RESOLUTION OF QUESTIONS, ITEMS OR ISSUES RAISED IN MEETING OR WITH SUPERVISOR

HEALTH AND SAFETY COORDINATOR	PROJECT MANAGER
FIELD TEAM LEADER	HAVE SITE WORKERS ATTENDING SIGN ON REVERSE SIDE. FORWARD A COPY TO THE PROJECT COORDINATOR

FIGURE 5.1
SAFETY MEETING REPORT (Page 2 OF 2)

TO BE SIGNED BY ALL SITE WORKERS ATTENDING THE MEETING			
I HAVE RECEIVED AND UNDERSTAND THE INFORMATION AND/OR TRAINING INDICATED ON THE REVERSE SIDE.			
SIGNATURE	**DATE**	**SIGNATURE**	**DATE**

LIST ALL SITE WORKERS ABSENT FROM THE MEETING	

FIGURE 5.2
SAFE WORK PERMIT (Page 1 of 2)

COMPLETED PERMIT MUST BE POSTED AT THE ENTRY OR WORK SITE.

ISSUED BY	DATE	TIME (FROM) ☐ A.M. ☐ P.M.	TIME (TO) ☐ A.M. ☐ P.M.
ACCEPTED BY		RESPONSIBILITY TRANSFERRED TO (NAME)	
LIST ALL WORKS (ON BACK) OR ATTACH ROSTER			

SECTION 1 — GENERAL AREA WORK PERMIT

1. WORK LIMITED TO THE FOLLOWING: (DESCRIPTION AND AREA/EQUIPMENT)

2. SAFETY EQUIPMENT (OTHER THAN AREA REQUIREMENTS) ☐ NONE

☐ RAIN SUIT	☐ GLOVES	☐ FACE SHIELD	☐ GROUND FAULT CIRCUIT INT.	☐ AIR PACK (SCBA)	☐ FIRE RESISTANT CLOTHING
☐ CHEMICAL SUIT	☐ HEARING PROTECTION	☐ HOOD	☐ BARRICADES/WARNING SIGN	☐ SUPPLIED AIR	☐ LONG SLEEVES
☐ RUBBER BOOTS	☐ CHEMICAL GOGGLES	☐ FALL RESTRAINT DEVICE	☐ COMMUNICATIONS EQPT (EST)	☐ RESPIRATOR	☐ OTHER

3. THE PERSON RECEIVING THE PERMIT VERIFIES THAT ALL WORKERS:

A. HAVE BEEN THROUGH THE SAFETY ORIENTATION	☐ YES	E. KNOW THE LOCATION OF THE PHONE OR INTERCOM	☐ YES
B. UNDERSTAND APPLICABLE HAZCOM AND RADIATION REQUIREMENTS	☐ YES	F. KNOW THE PROCEDURES FOR SAFE JOB COMPLETION	☐ YES
C. HAVE DISCUSSED HAZARDS OF THE JOB AND AREA	☐ YES	G. HAVE INSPECTED ALL TOOLS/EQUIPMENT	☐ YES
D. KNOW THE LOCATION/USE OF SAFETY EQUIPMENT	☐ YES	H. UNDERSTAND THE CLEAN UP REQUIREMENTS	☐ YES

PERMIT RECEIVER INITIALS _____

4. POTENTIALLY AFFECTED AREA PERSONNEL AND WORKERS NOTIFIED OF WORK TO BE DONE ☐ YES ☐ N/A

5. THE FOLLOWING RESPONSIBILITIES HAVE BEEN COMMUNICATED TO THE PERSON RECEIVING THIS PERMIT:

☐ CONDITIONS FOR WORK STOPPAGE	☐ PERFORMING THE WORK SAFELY	☐ COMPLETION OF SECTION 6 AND PERMIT RETURN
☐ CREW ACCOUNTABILITY	☐ REPORTING CHANGES THAT AFFECT JOB SAFETY	

SECTION 2 — AIR TESTS

PRIOR TO ENTRY OR HOT WORK ☐ DOES NOT APPLY

TEST IN ORDER INDICATED

1. OXYGEN METER TEST PERFORMED	☐ YES ☐ N/A	READING	%O_2	RANGE 19.5-23.5% O_2	TESTED BY	LOCATION OF TEST	TIME	☐ AM ☐ PM
2. COMBUSTIBLE GASES AND VAPORS TEST	☐ YES ☐ N/A	READING	%LEL	MAXIMUM 10% LEL	TESTED BY	LOCATION OF TEST	TIME	☐ AM ☐ PM
3. TESTS FOR TOXICS	☐ YES ☐ N/A	READING	☐ PPM ☐ MA/M^3	PEL/TLV ☐ PPM ☐ MA/M^3	TESTED BY	LOCATION OF TEST	TIME	☐ AM ☐ PM

SECTION 3 — HOT WORK

☐ DOES NOT APPLY

	YES	N/A		YES	N/A
1. FIRE EXTINGUISHER (TYPE) _____ IS IT FULL?			8. GROUND LEAD ATTACHED TO WORK		
2. SURVEY AREA FOR COMBUSTIONS AND OPENINGS, HOSES, TRENCHES, ETC.			9. PREVENTION OF HEAT EXPOSURE TO GASKET, SEALS, LINERS		
3. COMBUSTIBLE MATERIALS REMOVED OR PROTECTED			10. OTHER WORK IN AREA WHICH SHOULD BE STOPPED		
4. HEAT/SPARK CONTROL - TARPS, COVERS, WATER, ETC.			11. MATERIAL PRESENT WHICH EMITS VAPOR WHEN HEATED		
5. PRECAUTION TAKEN FOR HIDDEN COMBUSTIBLES			12. RADIANT HEAT TRANSFER CONSIDERED		
6. PURGE GAS USED. TYPE _____			13. EQUIPMENT OPERATING OR CONTAINS ORIGINAL CONTENTS		
7. ADJACENT AREAS SAFE/SEWERS PROTECTED			14. DUCTS OR CONVEYORS PLUGGES OR PROTECTED		

SECTION 4 — CONFINED SPACE

☐ DOES NOT APPLY

	YES	NO	N/A		YES	NO	N/A
1. CONFINED SPACE ENTRY REQUIRED?				5. HAVE AUTHORIZED ENTRANTS SIGNED OPPOSITE SIDE OF THIS FORM?			
2. SPACE TO BE ENTERED _____				6. HAVE DESIGNATED ATTENDANTS SIGNED OPPOSITE SIDE OF THIS FORM?			
3. PURPOSE OF ENTRY _____				7. HAVE ALL NECESSARY HAZARD CONTROL MEASURES BEEN TAKEN?			
4. IS SPACE A PERMIT-ENTRY SPACE? IF YES, COMPLETE OPPOSITE COLUMN				8. HAS ALL REQUIRED EQUIPMENT BEEN PROVIDED?			

SECTION 5 — TRENCHING/EXCAVATION

☐ DOES NOT APPLY

	YES	NO	N/A		YES	NO	N/A
1. HAS THE AREA BEEN INSPECTED FOR UNDERGROUND POWER LINES OR PRODUCT LINES?				4. HAVE PRECAUTIONS BEEN TAKEN IF THE TRENCH/EXCAVATION DEVELOPS INTO A CONFINED SPACE?			
2. DOES THE TRENCH REQUIRE SHORING/BRACING/SUPPORT?				5. HAVE OVERHEAD POWER/PRODUCT LINES BEEN REMOVED OR IDENTIFIED?			
3. HAS THE SOIL OR FILL BEEN EVALUATED FOR STABILITY?				6. WILL LEAKING WATER OR RAIN WATER AFFECT THE STABILITY OF THE TRENCH/EXCAVATION?			

SAFE WORK PERMIT (Page 2 of 2)

SECTION 6									
QUESTIONS TO BE COMPLETED ON PERMIT EXPIRATION OR JOB COMPLETION.			YES	NO	N/A		YES	NO	N/A
WORKER CLOSEOUT SIGNATURE		1. HAS THE JOB BEEN COMPLETED?				5. HAVE SAFETY DEVICES BEEN REINSTALLED?			
TIME	☐ AM ☐ PM	2. HAS THE AREA BEEN CLEANED OF WORK MATERIAL?				6. HAS HOT WORK AREA BEEN SURVEYED FOR SMOLDERING MATERIALS?			
		3. HAVE MANAGEMENT PERSONNEL BEEN INFORMED JOB IS DONE?				7. SPECIAL PRECAUTIONS, CONCERNS OR REMARKS			
		4. HAVE ALL LOCKS AND/OR TAGS BEEN REMOVED?				COMMENTS:			

OBSERVERS, WATCHERS, RESCUERS	I HAVE BEEN INSTRUCTED AS A CONFINED SPACE ATTENDANT, SAFETY WATCHER OR RESCUER AND UNDERSTAND MY DUTIES.			
	SIGNATURE	DATE	SIGNATURE	DATE

PERSONS AUTHORIZED TO PERFORM WORK AND/OR TO ENTER CONFINED SPACE	I HAVE BEEN INSTRUCTED IN AND AM AWARE OF THE POSSIBLE HAZARDS AND CONDITIONS I MAY ENCOUNTER IN THIS ENTRY WORK							
	SIGNATURE	TIME		DATE	SIGNATURE	TIME		DATE
		IN	OUT			IN	OUT	

COMMENTS	

AUDIT PURPOSE ONLY	

CORRECTIVE ACTIONS	

COMPLETED BY	NAME	TITLE	DATE

FIGURE 5.3
SITE SAFETY PLAN
LOW CONTAMINATION OF FUEL,
CHLORINATED PESTICIDES AND PNAs IN SOIL OR FILLS

SUMMARY INFORMATION

DATE: _____ UPDATE: _____

PROJECT NAME: _____ PROJECT NO:_____

LOCATION: _____

SITE CONTACT AND PHONE NUMBER: _____

TYPE OF FACILITY: (active or inactive - describe previous use, previous agency action, soil or fill type, topography, surrounding community)

PLAN PREPARED BY:_____

SITE SAFETY OFFICER:_____ CPR/FIRST AID TRAINED STAFF: _____

REVIEWED BY: _____ DATE: _____

WORK SCOPE/CONSTRUCTION/INVESTIGATION
Task 1_____
Task 2_____
Task 3_____

PROPOSED START DATE:_____

UNUSUAL FEATURES/SITE SECURITY (include site map): _____

UTILITIES: ☐Marked ☐ Scheduled Meet Date_____ Time_____

ANALYTICAL DATA (to be summarized below or attached, if available)
_____
_____

CONFINED SPACE: ☐Yes ☐ No (If yes, describe and address permitting and entry procedures in an attachment.) _____
_____

AIR MONITORING:
Monitoring equipment: HNu meter with 10.2 eV lamp or _____
Action level = 15 PID units in breathing zone for Level C upgrade. Stop work = 50 PID units in breathing zone.
☐ 0_2 meter, ☐ FID, ☐ Detector tubes, ☐ L.E.L. meter, ☐ Other_____

Other action levels: _____

PERSONAL PROTECTION: Level of Protection: ☐ A ☐ B ☐ C ☐ D
Special Requirements_____

COMMUNICATION EQUIPMENT: (Mobile Phone or other phone location and number, etc.)

_____

Scheduled Safety Meetings Interval: (daily, weekly, as needed)

SPECIAL SITE EMERGENCY COMMUNICATION PROCEDURES: (Evacuation signals, routes, spill containment)

HEAT/COLD STRESS CONTROLS:

SPECIAL PHYSICAL HAZARD CONTROLS: Barricades for work area, reflective vests, other, etc.

_____

LOCAL EMERGENCY RESOURCES AND TELEPHONE NUMBERS
Emergency Eye Wash/Shower Location:
Fire Extinguisher: _____
Police: _____
Fire Department:_____
Poison Control:_____
HOSPITAL: _____
Address: _____
Telephone: _____
Directions (supply map): _____
_____

EMERGENCY CONTACTS (name and phone number)
1. Construction Manager Contact: _____
2. Owner Contact: _____
3. Contractor Contact: _____
4. Subcontractor Contact:_____
5. Subcontractor Contact:_____
6._____
7._____

PRE-ENTRY SAFETY BRIEFING
I have received and read the _____ Low Contamination Health and Safety Plan. I understand the plan and had the opportunity to ask questions. I understand the information and instructions in the plan. I understand that medicine can complicate the effects from exposure to toxic chemicals. If I am taking any prescription or over the counter medicine or have a current medical condition which may increase my risks, I will advise my supervisor or Site Safety Officer.

Signature	Responsibility	Date
_____	_____	_____
_____	_____	_____
_____	_____	_____

6.0 COMMUNICATIONS

6.1 General Communications

The Field Team Leader will have available at the Site the means for telephone communications, or an equivalent means of communication, for summoning emergency assistance from the fire/ambulance and police departments in the event they are required. The telephone will also act as a direct link to technical personnel for information pertaining to all phases of the project.

6.2 Radio/Telephones

Short-range walkie-talkies or cellular telephones will be made available to designated personnel working at the Site.

6.3 Emergency Warning

In the event of an emergency condition, the Field Team Leader will notify project personnel verbally if all are within immediate hearing and via a bullhorn if the Site area is large. The Field Team Leader will also notify visitors present within the area. Site personnel will immediately proceed to a pre-designated assembly area as designated by the Field Team Leader during the daily safety meeting. Personnel will remain in the designated area until further instructions are received by the Field Team Leader.

All communication equipment will be tested at the beginning of each day to verify operational integrity.

6.4 Hand Signals

Hand signals will be used by field teams in conjunction with the buddy system. Hand signals shall be familiar to the entire field team before operations commence and should be reviewed during site-specific training.

Signal	Meaning
Hand gripping throat	Out of air; can't breathe
Grip partner's wrist	Leave area immediately; no debate
Hands on top of head	Need assistance
Thumbs up	OK; I'm all right; I understand
Thumbs down	No; negative

6.5 Site Security

Only authorized personnel will be permitted on the Site in accordance with the requirements of this HASP. Visitors and other non-essential personnel may enter the work area only upon authorization by the Field Team Leader. This restricted access will ensure that the Field Team Leader can communicate with each person authorized to enter the work area.

7.0 PERSONNEL EXPOSURE AND AIR QUALITY MONITORING

7.1 Air Quality (Dust)

Due to the nature of the principal contaminants associated with the project (radiation and PAHs), dust suppression will be important as a means of minimizing exposure levels and off-site migration of contaminants. A key control measure to minimize exposure levels and off-site migration of contaminants will be a policy of "no visible dust". The Field Team Leader will routinely monitor the project area. Acceptable dust levels (controlling all visible dust) will result in airborne dust levels of less than 1 mg/m^3. The OSHA nuisance dust standard of 15 mg/m^3 is not acceptable at this site, because of contaminants in the dust.

7.2 Airborne Radioactivity Monitoring

Monitoring for airborne radioactivity exposure is as important as monitoring for external radiation exposure. Monitoring for airborne radioactivity exposure requires the following elements:

- Air sampling for radioactive particulates,
- Recordkeeping regarding personnel work locations and time in location,
- Respiratory protective equipment records regarding devices used by workers in airborne radioactivity areas,
- Counting and analyzing air sample filters,
- Calculating air concentrations of radioactive material, and
- Comparing air concentrations to applicable air quality criteria

By closely monitoring these elements, a continuous record of personnel exposure to airborne radioactivity is maintained.

Lapel samplers worn for personal air monitoring shall be utilized for airborne radioactivity monitoring any time a worker enters a radiological exclusion zone. The filters from the lapel samplers shall be analyzed the following day after use for comparison purposes to assess the need for procedural changes. It is expected that naturally occurring radon and thorium daughters will interfere with analyses. Additional evaluation of samples shall be performed when determined necessary based upon elevated results. If sample analysis shows concentrations greater than background levels a follow-up analysis shall be performed. The follow-up analysis shall be performed after four days to allow for the decay of the thoron daughter Pb-212 (10.6 hour half life). The "four day count" should be free from radon daughter interference and will serve as the official measurement of Th-Alpha.

High volume air samplers shall be utilized so that effluent air quality can be gathered on a daily basis. High volume air sampling allows for much shorter collection times than low volume sampling and has equivalent dust loading for needed collection durations. Both high and low volume air samplings require a sufficient volume of air to be collected in order for the Minimum Detectable Activity (MDA) to be below the most restrictive air effluent guidelines. Daily analysis of samples will allow for necessary procedural changes to be made and alert health and safety staff to potential problems on a continuous basis, rather than once per week.

Time decay of interfering nuclides generally refers to radon-222 decay and daughters but may also include thoron decay. The specific times for decay of samples are best addressed in procedures rather than in the health and safety plan.

After filters have been collected and decayed overnight, there will be a morning count of the filter that will serve to identify high gross counts for the previous day. This will alert health and safety staff of a potential problem which they can investigate more promptly. The count, after 4 days decay, will serve to be the official measurement of Th-Alpha.

7.3 Internal Monitoring

Internal monitoring to determine intakes of radioactive material will be performed as needed based upon the results of the air sampling program. Bioassay methods to be considered should include in-vivo, as well as in-vitro, assessments. Routine bioassay of workers is not anticipated based upon the low concentrations of radioactivity in soil or fill to be excavated.

7.4 External Radiation Monitoring

External radiation monitoring of workers will be performed using film badges or thermoluminescent dosimeters. Dosimetry will be provided and processed by a service holding National Voluntary Laboratory Accreditation Program (NVLAP) certification. Pocket dosimeters may also be utilized for visitors and other infrequent personnel requiring access to the Site.

7.5 Radiological Surveys

Radiological surveys will be performed to ensure that radiation levels and contamination levels are within applicable guidelines for workers and the general public. Radiation surveys will be performed using the following instrumentation:

- Ludlum Model 2221 Portable Scaler/Ratemeter with 2”x2” NaI probe (or equivalent). This instrument will be used to conduct surface soil or fill scans. Instrument specific action levels shall be used to determine approximate radiological soil or fill concentrations. Any areas where the count rate is greater than the determined action level shall be considered exclusion zones and marked appropriately.

- Ludlum Model 3 Survey Meter with pancake G-M probe (or equivalent). This instrument will be used to conduct surveillance surveys of both personnel and equipment leaving exclusion zones. The action level for both equipment and personnel surveys is any count rate that exceeds background level. Decontamination procedures detailed in section 9.0 of the HSP will be used when contamination is located.

- Ludlum Model 3 Survey Meter with 1”x1” NaI probe “MicroR meter” (or equivalent) and Eberline Model RO-2 Ion Chamber (or equivalent). These instruments will be used periodically to ensure that dose rates in work areas as well as the Site perimeter are below prescribed levels. The action levels for both on and off site are detailed in Section 7.8 of the HSP in Table 7.1

Airborne radioactivity measurements will be performed as described in the Air Monitoring Procedure (Appendix E to the Removal Action Work Plan).

7.6 Contamination Monitoring

Samples shall be obtained periodically in work areas to ensure that radioactivity is present at acceptable levels and is prevented from leaving the Site. Decontamination of elevated areas will be performed to maintain contamination at levels that are ALARA.

Before leaving the exclusion zone, Site personnel shall be checked through use of a hand-held frisker to ensure that contamination is not present on skin or clothes. The frisker will be a Ludlum Model 3 survey meter with a pancake G-M probe (or equivalent). The trigger level for frisking will be any detectable counts above background in accordance with ALARA practices. The Field Team Leader will be immediately informed regarding any contamination on individuals and will initiate appropriate decontamination techniques. Proper disposition of contaminated personal effects and clothing also will be the responsibility of the Field Team Leader.

7.7 Total Organic Vapor Monitoring

In addition to the radiological contaminants, there is a very slight potential of encountering organic vapors. Thus, no routine screening for organic vapors will be conducted during the removal action. However, if organic odors are encountered during the field work screening for total organic vapors will be conducted with a photoionization detector (PID), or similar type equipment, on a daily basis. The screening will evaluate ambient photoionization volatile organic vapors and some semivolatile organic vapors.

Total organic vapors in ambient air will be obtained periodically with a PID during daily field activities. The PID provides real-time readings of exposure to volatile organics and some semi-volatile organics. Measurements will be made daily, prior to activities, to determine background levels. Monitoring measurements will be taken when:

- operations change,
- work moves to a different portion of the Site, and
- personnel observe contaminated materials.

These screening operations will be used to identify conditions requiring an upgrade to full-face respirators as described in Section 7.8.2.

7.8 Action Levels

7.8.1 Radiological Action Levels

Radiological action levels for on-site workers will be determined by performing surveillance surveys as well as airborne particulate monitoring for the presence of radioactivity. Properly trained Health Physics Technicians will perform radiological monitoring. The radioactive contamination on the Site is particulate and insoluble in water. Therefore, there will be no fixed contamination on the workers. Action levels as determined by radioactive monitoring can be found in Table 7.1.

To avoid the need for upgrade of personal protection equipment due to airborne contamination, engineering controls such as the use of water to minimize dust levels will be implemented as necessary during excavation and restoration activities.

7.8.2 Organic Vapors Action Levels

AECOM is taking a conservative approach to organic vapor monitoring at the Site. A PID will be used to periodically monitor for organic vapors or when odors indicated the possibility of organic contamination. Operations will be discontinued if the PID reads 5 ppm or greater above background and the area will be evacuated. The Site Health and Safety Officer will retest the area wearing a full-face respirator. Operations will not resume until the PID reads less than 5 ppm, and remains below 5 ppm.

TABLE 7-1
ACTION LEVELS AS DETERMINED BY RADIOACTIVITY

Note:

Personnel shall not be exposed to airborne radioactivity such that their weekly intake exceeds 12 Derived Air Concentration (DAC)-hours without prior approval of the Field Team Leader or designee.

Level of protection may be increased to Level C (full-face air purifying respirator) when airborne monitoring indicates that contamination levels have reached 30% of the DAC. All assessments shall incorporate ALARA principles. Engineering controls shall be used prior to assignment of respiratory protective equipment.

Signs shall be posted at entrances to areas where airborne radioactivity levels exceed, or have the potential to exceed, 25% of the DAC.

The most restrictive DAC of the nuclides which may be present onsite is Th-232. The DAC for Th-232 Class W is $5x10^{-13}$ uCi/ml. The air effluent limit is $4x10^{-15}$ uCi/ml. Engineering controls will be utilized so that no visible dust is present and airborne radionuclide concentrations will be kept ALARA.

Radiation Type	Action Level	Level of Respiratory Protection/Action
a. Contamination on smear samples of equipment	20 dpm/100 cm^2 gross alpha	Decontamination required prior to release for unrestricted use.
b. Contamination surveys of personnel or equipment	Count rate greater than background levels	Decontamination required prior to leaving exclusion zone.
c. Airborne Radioactivity	30% DAC(c)	Consider Level C (full-face APR) based upon ALARA evaluation. Ensure proper posting. Consider internal monitoring
d. Ambient Gamma (work areas)	5 mrem/hr(d)	Consider procedures for shielding of soil or fills. Ensure proper posting.
e. Ambient Gamma (off-site areas)	2 mrem/hr(e)	Implement immediate controls to reduce dose equivalent rate.

Notes

(c) Potential Airborne Radioactivity Area as defined in 10 CFR 20. Workers with 1000 DAC-hours per year to date must wear modified Level C (full-face APR) until the end of the calendar year.

(d) The ambient gamma dose equivalent rate action level of 5 mrem/hr stems, from the 10 CFR 20 radiation area definition. If the ambient gamma dose equivalent rate reaches 2 mrem/hr, one or more of the following actions will be implemented: The source may be shielded; the working distance from the source may be increased; or the worker's exposure time may be limited.

(e) The ambient gamma action level for off-site is based upon the 10 CFR 20 requirements to maintain dose equivalent rates in unrestricted areas such that they do not exceed 0.002 rem in any one hour.

8.0 PERSONAL PROTECTIVE EQUIPMENT

It is anticipated that most excavation activities in designated exclusion zones can be conducted in Level D personal protective equipment (PPE), with a contingency upgrade to Level C, based on the action levels listed in Section 7. Level C will be used when required by Special Work Permits, or when directed by the Field Team Leader.

Level D personal protective clothing and equipment for excavation activities includes:

- Coveralls, disposable or washable through a contaminated clothing vendor. Coveralls are to be removed at the boundary of the exclusion zone.
- Hard hat
- Steel toed boots and chemically resistant booties (exclusion zone)
- Cotton or leather gloves (no soil or fill contact); Nitrile gloves (Edmont 37-15 or equivalent) 0.40 mm thickness to be used if hand contact with soil or fill is probable.
- Safety glasses
- Dust mask (optional)

Level C protective clothing and equipment includes:

- Full-face air-purifying respirator (NIOSH/MSHA approved) fitted with radionuclides/HEPA cartridges and/or organic vapor cartridges, depending on which action levels are exceeded (see Section 7 of this HASP)
- Coveralls
- Tyvek coveralls - required in areas when splashing by contaminated soil, fill or water is a possibility
- Nitrile gloves (Edmond 37-15 or equivalent) 0.40 mm thickness
- Disposable latex inner gloves - required in areas when splashing by contaminated soil, fill or water is a possibility
- Nitrile outer gloves (taped) - required in areas when splashing by contaminated soil, fill or water is a possibility
- Steel toe boots with outer chemically resistant booties (taped)
- Hard hat

Action levels used to determine the need to upgrade or downgrade the levels of protection are described in Section 7 of this HASP.

9.0 CONTAMINATION REDUCTION PROCEDURES

9.1 Equipment

Portable equipment will be decontaminated with soap and water and rinsed with tap water. Heavy equipment will be steam-cleaned with water and, if necessary, a detergent solution.

9.2 Personnel

If levels of radioactivity show that individuals can remove coveralls and other personal protective clothing and equipment before leaving the exclusion zone and, thus complete decontamination, the individuals may leave the exclusion zone. If, however, levels of radioactivity show that individuals cannot achieve decontamination by the removal of coveralls and showering is required, they will be dressed in clean coveralls, boots and gloves and be transported to Northwestern Memorial Hospital to complete decontamination.

If substantial skin contamination occurs on an individual working with radioactive materials, the following specific procedures should be followed to prevent fixation of the material in the skin or absorption of the radioactivity through the skin.

Immediate Action: Notify the HSC or Field Team Leader, who will supervise the decontamination. If contamination is spotty, the HSC or Field Team Leader will supervise the cleaning of the individual spots with swabs, soap, or water. If the contamination is general, the HSC or Field Team Leader may recommend washing the area gently in warm or cool water (not hot) using hand soap (not detergent) for one minute. Rinse, dry, and monitor for radioactivity. This soap wash step may be repeated three times.

Evaluation: If the above procedure fails to remove all the skin contamination, the treatment should cease. An evaluation of the skin contamination should be performed by the HSC or Field Team Leader including an estimate of the dose commitment to the skin, and the quantity and identity of the nuclides contaminating the skin If additional decontamination steps are necessary, they are performed and documented by the HSC. The guidelines for Personnel Decontamination in the Radiological Health Handbook, HEW 1970, beginning on page 194, can be used as applicable. **CAUTION**: Do not use chemicals for personnel decontamination until full evaluation of the contamination is made by the HSC or Field Team Leader.

9.3 Contamination Prevention

Work practices that minimize the spread of contamination will reduce worker exposure and help ensure valid sample results by precluding cross-contamination. Procedures for contamination avoidance include:

- Knowing the limitations of all personal protective equipment being used;
- Avoiding walking through areas of obvious or known contamination;
- Refraining from handling or touching contaminated materials directly. Do not sit or lean on potentially contaminated surfaces;
- Ensuring personal protective equipment has no cuts or tears prior to donning;
- Fastening all closures on suits, covering with tape if necessary;
- Taking steps to protect against any skin injuries;
- Staying upwind of airborne contaminants; and
- When working in contaminated areas, refraining from eating, chewing gum, smoking, or engaging in any activity from which contaminated materials may be ingested

9.4 Disposal Procedures

All discarded materials, waste materials, or other field equipment and supplies should be handled in such a way as to preclude the spread of contamination, creating a sanitary hazard, or causing litter to be left on-site. All potentially contaminated waste materials (i.e., clothing, gloves) shall be monitored and segregated in accordance with monitoring results into either radioactive or non-radioactive waste. Appropriate labels shall be affixed to all containers of radioactive materials.

10.0 GENERAL WORK PRECAUTIONS

10.1 General Work Precautions

The following general work precautions apply to all Site personnel.

- Eating, drinking, chewing gum or tobacco, smoking, or any practice that increases the probability of hand-to-mouth transfer and ingestion of material is prohibited in the work area.
- Hands and face must be thoroughly washed upon leaving the work area. Wash water will be provided at the Site for this purpose.
- Whenever levels of radioactivity warrant, the entire body should be thoroughly washed, as soon as possible, after the protective coveralls and other clothing are removed as part of the decontamination process.
- No facial hair that interferes with a satisfactory fit of the mask-to-face-seal is allowed on personnel required to wear respirators.
- Contact with contaminated or suspected contaminated surfaces should be avoided. Whenever possible, do not walk through puddles, leachate, discolored surfaces, kneel on ground, lean, sit, or place equipment on drums, containers, or the ground.
- Medicine, drugs and alcohol may interfere with or impair judgment and reaction times. Therefore, usage of prescribed drugs must be specifically approved by a qualified physician and made known to the Field Team Leader prior to an individuals' presence on the work-site. Alcoholic beverage intake is strictly prohibited at the Site and prior to work.
- All personnel must be familiar with standard operating procedures and any additional instructions and information contained in the HASP.
- All personnel must adhere to the requirements of the HASP.
- Contact lenses are not permitted when respiratory protection is required or where the possibility of a splash exists.
- Personnel must be cognizant of symptoms for radiological exposure onsite, for heat stress and cold stress, and knowledgeable regarding emergency measures contained in the Emergency Contingency Plan.
- Respirators shall be cleaned and disinfected after each day's use or more often, if necessary.
- Prior to donning, respirators shall be inspected for worn or deteriorated parts. Emergency respirators or self-contained devices will be inspected at least once a month and after each use.
- Each employee shall be familiar with the project's Respiratory Protection Program.

10.2 Operational Precautions

The following operational precautions must be observed at all times.

- All Site personnel shall be adequately trained and thoroughly briefed on anticipated hazards, equipment to be worn, safety practices to be followed, emergency procedures, and communications.
- All required respiratory protective devices and clothing shall be worn by all personnel going into areas designated for wearing protective equipment.
- All Site personnel shall use the buddy system when wearing respiratory protective equipment. At a minimum, a third person, suitably equipped as a safety backup, is required during extremely hazardous entries.
- During continual operations, on-site workers act as a safety backup to each other. Off-site personnel provide emergency assistance.
- Personnel should practice any unfamiliar operations prior to undertaking the actual procedure.
- Entrance and exit locations shall be designated and emergency escape routes delineated. Warning signals for Site evacuation must be established.
- Personnel and equipment in the contaminated. work area should be minimized, consistent with effective Site operations.
- Work areas for various operational activities shall be established.

- Procedures for leaving a contaminated area shall be planned and implemented prior to going on-site. Work areas and decontamination procedures shall be established based on expected Site conditions.
- Frequent and regular inspection of Site operations will be conducted to ensure compliance with the HASP. If any changes in operation occur, the HASP will be modified to reflect those changes.

11.0 SANITARY FACILITIES

11.1 Potable Water

a. An adequate supply of potable drinking water shall be maintained at all times immediately outside the Site. Drinking water shall meet all federal, state and local health requirements.
b. Drinking water shall be supplied to project personnel via approved dispensing sources.
c. Paper cups shall be permitted for the drinking of potable water supplies.
d. Drinking water dispensers shall be clearly marked and shall, in no way, have the potential for contamination from non-potable supplies.
e. Site personnel must be fully decontaminated prior to approaching the drinking water supply.

11.2 Toilet Facilities

a. Adequate toilet facilities shall be provided at the Site.
b. These facilities shall be in the form of portable chemical toilets.
c. Routine servicing and cleaning of the toilets should be established with the selected contractor and shall be in accordance with federal, state, and local health regulations.
d. Site, personnel must be fully decontaminated prior to approaching the toilet facilities.

11.3 Washing Areas

a. Adequate washing areas shall be provided for personal use within the work area.
b. Washing areas shall be maintained in a sanitary condition and will be provided with adequate supplies of soap, towels for drying, and covered waste receptacles.
c. Washing areas shall be maintained and sanitized daily.
d. No eating, drinking or smoking shall be permitted in the work area. This policy will be strictly enforced by the Field Team Leader.

12.0 FIRE CONTROL EQUIPMENT

An adequate number of approved portable fire extinguishers (class rated A, B and C) shall be readily available at the Site at all times.

All Site personnel shall be trained in the use of the extinguishers. Extinguishers shall only be used on outbreak stage fires or fires of minor nature. The local fire department shall be contacted in the event of a larger fire and Site evacuation procedures should be commenced in accordance with the procedures described in the Emergency Contingency Plan.

13.0 CONFINED SPACE PROGRAM

13.1 Purpose

In the event that confined space work is a necessity, a Confined Space Program will be implemented. Training in the recognition of confined spaces is a component of the health and safety training program.

The purpose of the Confined Space Program is to establish procedures to protect personnel from this serious hazard in the course of their work; and at a minimum, to comply with 29 CFR OSHA 1910.146. This document assigns responsibilities and sets standards for personnel engaged in activities where confined spaces may be present.

13.2 Responsibilities

13.2.1 Health and Safety Coordinator

The Health and Safety Coordinator administers the Confined Space Program. The Health and Safety Coordinator's responsibilities include:

- Review of the HASP for potential confined space hazards and design alternative approaches to accomplish the confined space tasks;
- Coordinating and managing the Confined Space Program in the event one is required;
- Establishing priorities for implementation of the program;
- Assisting with recognition and implementation of the Confined Space Program;
- Advising project management on confined space issues; and
- Communicating the Confined Space Program to personnel by training related to specific Site activities.

13.2.2 Project Manager

The Project Manager directs the application of the Confined Space Program to project work. The Project Manager is responsible for:

- Working with the Health and Safety Coordinator to prepare information describing activities that might be conducted in a confined space area;
- Assuring that all personnel engaged in project activities are familiar with the definition of a confined space;
- Assuring that personnel are familiar with the Confined Space Program, and that project activities are conducted in compliance with the Confined Space Program;
- Assuming the responsibilities of the Field Team Leader if another person is not assigned these responsibilities.

13.2.3 Field Team Leader

The Field Team Leader is responsible for the implementation of the Confined Space Program on-site during field activities. The Field Team Leader is responsible for:

- Overseeing implementation of the Confined Space Program during field operations; and
- Reporting confined space work activity, and any violations of the Confined Space Program, to the Project Manager and the Health and Safety Coordinator.

13.2.4 Personnel

Personnel are responsible for:

- Familiarizing themselves with the Confined Space Program and following it;
- Becoming familiar with the criteria for determining a confined space, and with the monitoring, permitting, and other requirements of the program; and
- Reporting immediately a confined space condition to the Field Team Leader.

13.3 Definition of a Confined Space

Confined space means a space that:

1. Is large enough and so configured that an employee can bodily enter and perform assigned work
2. Has limited or restricted means for entry or exit (such as pits, storage bins, hoppers, crawl spaces, and storm cellar areas)
3. Is not designed for continuous employee occupancy

Any workspace meeting all of these criteria is a confined space and the Confined Space Program must be followed.

13.4 Confined Space Entry Procedures

13.4.1 Safety Work Permit Required

All spaces shall be considered permit-required confined spaces until the pre-entry procedures demonstrate otherwise. The Safe Work Permit for entry into a confined space must be completed before work begins; it verifies completion of the items necessary for confined space entry. The Permit will be kept at the Site for the duration of the confined space work. If there is an interruption of work, or the alarm conditions change, a new Permit must be obtained before work begins.

A permit is not required when the space can be maintained for safe entry by 100% fresh air mechanical ventilation. This must be documented and approved by the Health and Safety Coordinator. Mechanical ventilation systems, where applicable, shall be set at 100% fresh air.

The Field Team Leader must certify that all hazards have been eliminated on the Entry Permit. If conditions change, a new permit is required.

13.4.2 Pre-entry Testing for Potential Hazards

a. Surveillance

   Personnel first will survey the surrounding area to assure the absence of hazards such as contaminated water, soil, fill or sediment, barrels, tanks, or piping where vapors may drift into the confined space.

b. Testing

   No personnel will enter a confined space if any one. of these conditions exists during pre-entry testing. Determinations will be made for the following conditions:

   1. Presence of toxic gases or dusts: Equal to or more than 5 parts per million (ppm) on the organic vapor analyzer with an alarm, above background outside the confined space area; or other action levels for specific gases, vapors, or dusts as specified in the Health and Safety Plan and the Confined Space Permit based on knowledge of Site constituents;

   2. Presence of explosive/flammable gases: Equal to or greater than 10% of the Lower Explosive Limit (LEL) as measured with a combustible gas indicator or similar instrument (with an alarm); and

3. Oxygen Deficiency: A concentration of oxygen in the atmosphere equal to or less than 19.5% by volume as measured with an oxygen meter.

Pre-entry test results will be recorded and kept at the Site for the duration of the job by the Field Team Leader. Affected personnel can review the test results.

c. Authorization

Only the Field Team Leader and the Health and Safety Coordinator can authorize any personnel to enter into a confined space. This is reflected on the Safe Work Permit for entry into a confined space. The Field Team Leader must assure that conditions in the confined space meet permit requirements before authorizing entry.,

d. Safe Work Permit

1. A Safe Work Permit for confined space entry must be filled out by the Health and Safety Coordinator or Field Team Leader. A copy of the Safe Work Permit is included as Figure 5.2.

e. Attendants

One worker will stand by outside the confined space ready to give assistance in the case of an emergency. Under no circumstances will the standby worker enter the confined space or leave the standby position. There shall be at least one other worker not in the confined space within sight or call of the standby worker.

f. Observation and Communication

Communications between standby worker and entrant(s) shall be maintained at all times. Methods of communication that may be specified in the Safe Work Permit and the HASP may include voice, voice by powered radio, tapping or rapping codes, signaling tugs on rope, and standby worker's observations that activity appears normal.

13.4.3 Rescue Procedures

Acceptable rescue procedures include entry by a team of rescuers only if the appropriate self-contained breathing apparatus (SCBA) is available; or use of public emergency services.

The standby worker must be trained in first aid, CPR, and respirator use. A first aid kit should be on hand and ready for emergency use. The standby worker must be trained in rescue procedures. Retrieval of an unconscious victim in a confined space will only be conducted by trained rescue personnel. An emergency call to 911 will be initiated to assist the victim.

13.5 Training

Personnel who will engage in field activities will be given annual training on the requirements and responsibilities in the Confined Space Program and on OSHA 1910.146. Only trained personnel can work in confined spaces. Workers should be experienced in the tasks to be performed, instructed in proper use of respirators, lifelines and other equipment, and practice emergency procedures and self-rescue.

Before each Site activity, the determination of confined space work will be part of the Site characterization process. Training in the site-specific confined space activities will be part of the site-specific health and safety training:

13.6 Safe Work Practices

- Warning signs should be posted. These include warnings for entry permits, respirator use, prohibition of hot work and emergency procedures and phone numbers.
- Cylinders containing oxygen, acetylene or other fuel such as gasoline must be removed a safe distance from the confined space work area.
- Purging and ventilating is done before work begins to remove hazardous vapors from the space. The space should be monitored to ensure that the gas used to purge the space (e.g. tank) has also been removed. Local exhaust should be used where general exhaust is not practical.
- The buddy system is used at all times. A standby person always must be posted within sight of, or in communication with, the person inside the confined space. The standby should not enter the confined space, but instead will call for help in an emergency and not leave the post. Communication should be maintained at all times with workers inside the confined space.
- Emergency planning in the HASP and a Safe Work Permit must be approved in advance and the proper rescue equipment must be immediately available.

14.0 ELECTRICAL LOCKOUT/TAGOUT

The Field Team Leader must approve all work in areas requiring lockout/tagout procedures. Specific procedures and permitting requirements will be specified in the HASP, or in a revised HASP based on the need for a worker to work around electrical equipment.

All systems must be locked out and tagged before the work begins. This includes pipes, air lines, electrical equipment and mechanical devices. The equipment must be start tested and approved for use by a worker by the Health and Safety Coordinator or the Field Team Leader by start-testing to make sure the locked-out equipment does not operate.